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Abstract

This dissertation presents three essays in Chinese reforms and household savings. Chapter 1 is a survey paper, which reviews the relation between various of Chinese reforms and urban households' saving decisions and focuses on the housing finance reform and the health care reform. The housing finance reform may promote the households to accumulate wealth for the home purchase in the future; the health care system reform could induce the households' out-of-pocket expenses and the strong saving motives. According to our knowledge, there is little empirical evidence on the relation between the 1999 housing finance reform and the saving rate and the relation between the 1998 health care reform and the saving rate.

Chapter 2 focuses on the partial package of the housing finance system, namely the institution of the Housing Accumulation Fund (HAF), in which both the employer and the employee contributed a fixed amount of employee's wage. We use two waves of the Chinese Household Income Project Survey (CHIPS) in 1995 and 2002 and adopt a two-step estimation procedure to explore the HAF effect on the household saving rate and the home ownership. Our estimation results provide evidence of the positive effect of HAF on the saving rate, as well as the positive effect of HAF on the home ownership. To be more precise, households with higher accumulated amount of HAF save more and are more likely to have private houses. Our results imply that there is an incomplete credit market, where purchasing houses becomes feasible but the down payment is high and loans are not enough to purchase a house, could stimulate more savings rather than help people to smooth consumption. In addition, HAF helps the households to be home owners and serves as a way to motivate the accumulation of financial sources to be used as a down payment.

Chapter 3 is a joint work with Dr. Noemi Pace. In this Chapter, we focus on the third stage of the health care reform in 1998. In 1998 China established a new nationwide public insurance scheme, which replaced the Labor Insurance Scheme and

the Government Insurance Scheme, called the Basic Insurance Scheme. Using two waves of the Chinese Household Income Project Survey in 1995 and 2002, we explore the public health insurance effect on the household out-of-pocket expenses and the saving rate in both years. We find that, before the 1998 health care reform, the public health insurance served as a cushion against the health risk, reducing the households' out-of-pocket expenses and saving for precautionary motive, on the contrary after the health care reform the public health insurance seems to be ineffective as a source of protection against income losses.

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To my loving parents.

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Chapter 1

Survey: Chinese Reforms and Chinese Household Saving Decisions

1.1 Introduction

Given the large size of the Chinese economy and the importance of the household sector, considerable studies have been devoted to understand Chinese household saving decisions. Almost all studies find that Chinese households have high saving rate compared with that in the developed nations after the 1970s. As the Chinese households were known to be thrifty, during the reform period, their consumption growth would have lagged behind their income growth, thus leading to the high household saving rate. This argument is supported by the empirical finding that provincial level variations in household saving over time and space are influenced by lagged the household's consumption (Horiaka and Wan 2007). However, the empirical evidence is inconclusive. The traditional and commonsensical explanation counts little. Indeed between the 1950s and the middle of the 1970s, the households saving rate in China was always below 5 percent, and the sharp increase occurred during the reform period (Modigliani and Cao 2004). Studies based on household data provide the em-

pirical evidence to show that the thrift is not relevant to explain the household high and increasing saving rates (Chamon and Prasad 2010). Using panel data, studies document that older cohorts are more likely to be thrift than younger cohorts (Zhou 2007). The author rejects the thrift factor as an important determinant of Chinese household saving. Indeed, younger cohorts actually have a higher propensity to save than older cohorts after controlling for other saving determinants. It seems that the thrift is not an alternative determinant to explain the Chinese urban household high saving rate.

Starting from the end of the 1970s, China has launched its reforms in the economic sector and the social security system, such as housing, health care system, pension, etc. The main objective of the Chinese reforms was to transform China's stagnant, impoverished central planned system into a decentralized system capable of generating strong economic growth and increasing the well-being of Chinese citizens. The economic reform began in 1978 and occurred in two stages. The first stage, between the late 1970s and the early 1980s, involved the de-collectivization of agriculture, the opening up of the country to foreign investments, and the permission for entrepreneurs to start up businesses. However, most industries remained state-owned. The second stage of the reform, between the late 1980s and the 1990s, involved the privatization and contracting out of much state-owned enterprises (SOEs) and the lifting of price controls, protectionist policies, and regulations, although state monopolies in sectors such as banking and petroleum remained state-owned. The private sector grew remarkably, accounting for as much as 70 percent of China's GDP by 2005, a figure larger in comparison to many Western nations. From 1978 to 2010, unprecedented economic growth occurred, with the GDP increasing by 9.5 percent a year (Chinese Statistical Yearbook 1980-2010). China's economy became the second largest after the United States.

From 1953 to 1978, the saving rate of urban Chinese household was flat, whereas starting in 1978, it started to increase until the beginning of the 1990s and reached as high as 35 percent (Modigliani and Cao 2004). Owing to the rapid income growth, the Chinese households saved a lot and their saving rates increased in recent years. The average saving rate of urban households relative to their disposable income rose from 17 percent in 1995 to 24 percent 2005 (Chamon and Prasad 2010 and Yang, Zhang, and Zhou 2010). Moreover, empirical studies provide descriptive statistics to show that the economic sector reform induced the uncertainty on income and consumption, which reenforces urban households to have precautionary savings (Ma and Yi 2010 and Kraay 2000). Some studies use a simple growth model to show that uninsured risk induced by the economic transition partially alters the relation between the marginal propensity to consume and the permanent income. Instead of consuming, the high income households prefer to save more (Wen 2010 and Wang and Wen 2011). Accompany with the economic reform, there were a high inflation and low interest rate period between the end of the 1980s and the middle of the 1990s. The high saving rate of the Chinese households was a little bit induced by the high inflation rate (Modigliani and Cao 2004). For what concerns the interest rate effect on the households' saving decisions, studies analyze the high household saving rate is partially induced by this inflation (Aaberge and Zhu 2001). Other studies also find that the nominal interest rate has considerable importance in influencing saving behaviors (Feltenstein, Lebow, and Van Wijnbergen 1990). Using panel data of China's provinces over the period 1996-2009, during which urban household has a high saving rate, studies find that the increase in the household saving rate is negatively associated with the decline in real interest rate over this period (Nabar 2011). The empirical evidence also implies the negative relation between the interest rate and the saving rate in the period of the late 1980s (Aaberge and Zhu 2001).

The Chinese economic reform generated a booming market. Abundant consumption goods were supplied to the domestic market, whereas the households' consumption capacity was low. Improving the households' consumption capacity became an important issue to retain high economic growth. From 1991, all commercial banks were allowed to operate personal consumption loan businesses to households. Personal consumption loan businesses included the housing loan, the auto loan, the education loan, the durable goods loan, etc., where the housing loan and the auto loan accounted for most of total amount of the personal consumption loan. Chinese commercial banks granted personal consumption loans prudentially. They did not want to grant loans to households for three main reasons: lack of personal credit record, without good guarantee, and high risk compared with SOEs. The households were reluctant to get bank loans, since the process of the loans were complicated and long, the requirement was harsh. Previous practices indicated that the most notable feature of the personal consumption loan was the very low default rate. Studies suggest that the government should establish a nationwide personal credit record system, develop guarantee institutions and other instruments (Yang and Fan 2001).

The Chinese government also implemented a series of reforms in the social security sector, including housing, health care system, education, pension, etc., to private expenditures on these lumpy purchases. For example, expenditures on the health care service and the education only accounted for 2 percent of household consumptions in 1995, but this share rose to 14 percent by 2005 (Yang, Zhang, and Zhou 2010). In this paper, we mainly review the effects of three certain social security system reforms on households' saving decisions, namely the housing finance reform, the health care system reform and the pension reform. The Chinese housing finance reform, as a partial package of the Chinese housing reform, aimed to shift the previous centralized housing finance system to the decentralized system, in which urban employees, employers, and financial institutions were involved. The housing finance reform constituted on

first enhancing the housing mortgage market; second establishing a dual housing saving programme, in which both the employer and the employee were included, namely the Housing Accumulation Fund (HAF) program. The housing finance reform was to help the urban households to be home owners, and thus affected the households' saving decisions. The Chinese health care system was founded in the 1950s. Before 1978 the health care system contained two main packages, one which was the labor insurance schemes (LIS) serving the employees working in SOEs; the other which was the government insurance schemes (GIS) serving the governments' and institutions' employees. Both packages provided free medical treatments, medicines and hospitalizations for the employees entirely and reimbursed their dependents partially. The health care reform corrected the health system deficiencies, since some SOEs could not make any profits and could not afford the employees medical costs, and it transformed the previous LIS and GIS to a nationwide social insurance system, which pooled risks for all the urban employees, including both public and private employees at city level. In addition, the employees' dependents would not be reimbursed any more after reform.

The remainder of this paper is organized as follows: in Section 2 we review the housing finance reform effect on the household saving rate. We first provide a brief introduction of the institutional backgrounds of the housing finance reform. We then review the impacts of both HAF and the personal credit market reform on households' saving decisions separately. Section 3 discusses the health care reform effect on households' out-of-pocket expenses and saving decisions. Section 4 reviews the pension reform effect on household saving decisions. Finally, Section 5 concludes.

1.2 Housing Finance Reform

Before the housing reform, all the housing investments were centralized at the government level. Urban employers could undertake the housing investment and construct the welfare houses for their employees. The welfare houses were charged a symbolic fee, which was even lower than the maintenance cost. To alleviate the employers' maintenance burden, the Chinese government started to privatize the existing public housing stocks at the end of the 1980s. In the process of privatizing the existing public housing stocks, the Chinese government realized that there existed a gap between households' income and the house prices. To bridge the gap, the central government started to reform the housing finance system in 1994.

The housing finance reform contained two packages: the establishment of a dual saving program, in which both the employer and the employee were included, and the development of the housing mortgage market. The dual saving program consisted in the introduction of the Housing Accumulation Fund system. Followed the successful experiences of Singapore Central Provident Fund, Shanghai in 1991 firstly established the HAF system. In 1994, the central government expanded HAF nationwide. However, between 1994 and 1999, HAF was not compulsory for all the urban employers. In 1998, HAF became compulsory to all the urban employers, permanent employees, and the long-term contract employees. Once the employer decided to institute HAF, it created a one-to-one matched HAF account in China Construction Bank for each employee.¹ The employee, whose employer has already instituted HAF, had to contribute to HAF. However, the employee could not contribute to HAF individually, if his employer did not institute HAF. Both the employer and the employee contributed a fix percent of the employee's wage into the HAF account.² The employee owned

¹China Construction Bank is one of the four state-owned commercial banks.

²Between 1994-1999, the percentage of contribution was different across provinces. After 1999, the central government required the lowest percentage of contribution to be 5 percent of the employee's salary for both the employer and the employee.

the account, all money in it and earned risk free interest rate. The employee was expected to apply for the HAF subsidized loans, in which the interest rate was in general one percent lower than the benchmark rate. The the local HAF management department had to manage all HAF accounts, grant HAF subsidized loans, invest the accumulated funds. Most of the accumulated funds were invested in the national bond, which was not an efficient manner to invest. The local department was trying to look for other efficient channels to invest in. Finally, HAF subsidized loans performed very well, because the default rate was around 0.07 percent in both 2006 and 2007 (The People's Bank of China 2007 and 2008).

The second package of the housing finance reform consisted in developing the housing mortgage market. In 1994, the Chinese government started to introduce the commercial mortgage loans to home buyers nationwide. The amount of the housing loan, as a component of the personal consumption loans, accompany with that of the auto loan accounted for most amount of the amount of the personal consumption loan. In the following, we mainly focus on the housing mortgage market reform. Before 1998, Chinese commercial banks were not comfortable to provide mortgage loans to households and often imposed restrictions on the loan origination. The commercial banks bore most risk of personal loans, since the legal system and the secondary market were not complete (Fan and Liu 2006). In addition, the commercial banks did not use the risk pricing mechanism and could not investigate the borrowers' repaying capacity very well (Wu et al. 2005). Between 1994 and 1998, the situation has been changed a bit. For example, the People's Bank of China (PBoC) published the regulatory document "Residential Mortgage Lending Regulations", which established basic housing mortgage lending standards, such as extending maximum mortgage term of 30 years and a minimum down payment ratio of 30 percent of the total house value (Deng, Shen, and Wang 2009). Although the personal consumption loan business grew rapidly, it accounted for few amount of the total bank loan. This was

because there did not exist a risk management system in commercial banks, and the personal credit system and rating system were still not complete. However, one feature of the personal consumption loans was default rate was much lower than that of the project loans to state-owned enterprises (Deng and Liu 2006).

In the rest of this section, we want to review the studies on the HAF effects on households' saving decisions. The reform of the personal credit market can be considered as an efficient proxy of the reform of housing mortgage loan market. We also review the personal credit market reform effects on the household saving rate.

1.2.1 Housing Accumulation Fund Effects on Household Savings

Regardless of purchasing the housing stocks in the reform or purchasing the market houses, the households with any HAF contributors could apply for the HAF subsidized loans. It is relevant to examine the relation between HAF and the household saving rate. To the best of our knowledge, there is no study to test this relation. The home ownership is endogenous, since the housing reform provisions did encourage household to purchase in the reform. The households associated with different home ownership situations have different saving behavior. The home ownership situations constructs a link between HAF and the saving rate. In this section, we first review the HAF effect on the home ownership, then discuss the different home ownership situation effect on the saving rate.

Using a subsample of the Urban Household Survey conducted by the Chinese National Bureau of Statistics, studies show that the proportion of households that own or partially own their houses increased substantially from 17 percent in 1990 to 86 percent in 2005, largely as a result of the housing reform that took place over the 1990s (Chamon and Prasad 2010). The authors also find that, in 2005, 58 percent of the home owners in their sample had purchased private houses through the housing

reform. The home ownership rate among households with heads aged between 25-35 is nearly identical. The authors provide the empirical evidence to show that a smaller share of younger households obtained their homes through the housing reform. Other studies find that, owing to both massive public housing privatization and strong government incentives for home purchase, the home ownership rate in China reached 80 percent in 2004; in fact, homes have become the most important new form of the private property for the urban Chinese households (Feng 2003). Still, the impact of HAF on the home ownership is not clear. Especially for HAF contributors, the subsidized housing mortgage may motivate them to purchase houses. Unfortunately, there does not exist any empirical study to test the relation between HAF contribution and home ownership.

Some studies present descriptive statistics to compare differences in the house quality, the cost, etc., between HAF fund users and no HAF users in Beijing municipality (Duda et al. 2005). Their results indicate that the housing quality and the cost induced by owners that used HAF funds and those that did not are substantially different. On the housing quality variables, HAF fund users appear to fare much better than others. On average they live in buildings that are 6 years newer. HAF users also occupy units that are 16 percent larger and enjoy 25 percent more living space per resident and bought more expensive units. It is tempting to conclude that although the results are suggestive of some potentially interesting relations between the policy variable and tenure or quality outcomes, it is hard to give conclusions from these simple descriptive results. Ideally the direction of influence problem between the potential dependent variables of tenure type and the unit size caused by the preponderance of privatized units could be dealt with by excluding privatized units.

There exist some contributions that consider the relation between the home ownership and the household saving rate. Using a panel data, the anecdotal evidence suggests much of the privatized housing stock is unappealing and many households

could save more to purchase new dwellings (Chamon and Prasad 2010). They use the OLS estimation to show that the households in higher valued homes save substantially less than those that do not own a home or live in a low value houses. However, the estimated housing value variable is not available in 1992-1996 survey. They cannot test whether this is indeed what is driving the housing-related results in earlier years. The effects of home ownership on savings depend on the age of the household head. A young household head who does not own a private house is more likely to be saving to purchase one than a 65 year old household. In addition, when considering the interaction dummy between the home ownership and the age group dummies, they find that the home ownership continues to have a positive effect on the saving rate in 1992-1996 and 1997-2001, although the coefficients on the age interactions are not statistically significant. In 2002-2005 sample, home ownership implies a large reduction in savings for younger households but not for older ones. In that sample, the coefficient of the home ownership dummy is negative and significant. However, the coefficient on its interaction with age are positive, and the combined effect gradually declines as they move from the 25-29 age group towards older households. The results are similar when the imputed rents reported in the survey are used. Brugiavini, Weber and Wu (2010) also use a simple OLS estimation to analyze the home ownership effect on the saving rate. They find that households that are renting private households save marginally and insignificantly less than those renting public housing. In addition, home owners save significantly more than households that do not have any private house, particularly those who bought in the market after the reform. It confirms that home owners need to improve the quality of the housing stock or move up the housing ladder. Unfortunately, these two contributions use the simple OLS estimations and do not take into account the endogeneity problem induced by the home ownership. The endogenous home ownership may lead to a sample selection

bias. If the endogeneity problem is considered in the estimation procedure, the home ownership might have different effects on saving rates.

1.2.2 Personal Credit Market Reform Effects on Household Savings

We now move to consider the personal credit market reform effects on the household saving decisions. As we have already introduced, before 1998, the commercial banks were not comfortable to offer loans to urban households. The borrowing constraint was an important cause to explain the household saving decisions. In the late 1980s, there was virtually no access to the commercial credit market for the Chinese households. It is therefore natural to assume that household savings, the most important form of which is bank deposits, plays an important role in acquisition of consumer durable goods (Aaberge and Zhu 2001). They find a positive relation between the value of purchase durable good and savings. The households prefer to save for future consuming the durable goods than to consumer immediately, owing that they were reluctant to obtain the bank loans (Wu et al. 2005).

The PBoC in 1998 issued some regulatory documents, which encouraged commercial banks to grant loans to urban households. As the personal consumption loan business has developed gradually, it was likely that these credit constraints became less important, raising the possibility that saving would fall as a result (Kraay 2000). Although simulations of theoretical models suggest that the presence of liquidity constraints does not lead to very large buffer stocks of wealth, this factor may be more important in understanding the household saving decisions. Some studies document that the borrowing constraints still exist in China after 1998 (Wen 2000 and Wang and Wen 2011). They use a permanent income model and show that the borrowing constraints motivate urban households to save more. In contrast, some studies document that households have responded to unprecedented new affluence by making

large adjustments to their stocks of durable goods over a relatively short period of time (Ma and Yi 2010). The authors indicate that the borrowing constraint is still a cited factor accounting for the high personal saving. However, commercial bank loans to the Chinese household sector have expanded substantially, reaching of the total outstanding bank loans lately from less than 1 percent in the late 1990s to 10 percent at the beginning of the 2000s. In other words, the availability of consumer credit does not appears to be a major binding constraint to consumption smoothing for the period under study and is unlikely an important cause behind the rising of the personal saving propensity in the past 10 years.

1.3 Health Care Reform

In China, over the past decades, LIS and GIS have played an important role in providing the urban employees with health services, thereby contributing to economic development and social stability. Both LIS and GIS were the third-party insurance, providing comprehensive benefits with minimal cost sharing to constrain beneficiaries on their consumption of medical services. LIS was an enterprises-based insurance scheme, which bore all the employee's cost of medical care service. Confronted with a drastic worsening of financial position in the economic reform, many SOEs were forced to default on their responsibilities to pay their employees' medical bills. Consequently, employees, retirees, who have worked in the SOEs which could not make any profits, would loose the opportunity to be reimbursed basic health care bills. Instead, they had to pay for their health care services out-of-pocket. The lack of such a social protection project has slowed down the reform of SOEs. GIS was the public medical scheme for employees, who were working for government agencies and public institutions. Under GIS, the employees' medical costs were covered by the government budget allocation (Gu and Tang 1995, Liu and Hsiao 1995). Even in the economic transition, those

employees' health care costs were always reimbursed by GIS. Consequently, there was an inequality in the health care expenses between employees working in SOEs and in the governments and the institutions. Meanwhile, the costs of the medical treatments, the medicines, and the hospitalizations have increased substantially. To solve the inequity problem and the cost escalation, the Chinese government started to implement a series of reforms in the urban health care system at the beginning of the 1980s.

At the beginning of the 1980s, China started to implement a whole series of reforms in the urban health insurance system. The overall reform contained three main stages. The first stage was between the early 1980s and 1991; the second stage began in 1992 with city wide pilot reforms; the third stage was the health care insurance reform in 1998. During the first stage, the primary objective of the reform was the cost containment. Major reform measures included the introduction of the employees' partially sharing his health care cost. These measure played a role in mitigating China's rapid health care cost escalation, relieving some of the financial pressure on enterprises, and decreasing the inequity of health care expenses between the employees in SOEs and in government and institutions. Starting in 1992, the main objective of the health care reform shifted to the more fundamental problems, especially increasing the level of risk pooling, along with the original target of the cost containment. In early 1995, Jiujiang city and Zhenjiang city began their pilot health insurance reforms. In both cities, the health insurance system reform combined the individual responsibility with the social protection through city wide risk pooling for LIS and GIS beneficiaries. In December 1996, China held the first National Health Conference to develop major health care reform provisions. The key issues contained establishing effective mechanism for controlling the health care demand and its supply, seeking scientific and appropriate methods to control the excessive health care cost growth and expanding the public insurance coverage to all urban employees gradually.

The third stage began at the end of 1998 and established a new health insurance system. The main objectives of the new health insurance system were to establish a basic social insurance system for a broad range of the urban employees, to control medical cost escalation, and to improve efficiency and quality. In December of 1998, the central government announced to establish a social insurance system, the basic insurance system (BIS), which would replace the existing LIS and GIS for urban employees in cities. Compared with the previous LIS and GIS, GIS expanded coverage to private enterprises and small public enterprises. Moreover, self-employed and rural industry employees may buy into the system, but were not compulsory to enroll. However, employees' dependents could not be reimbursed anymore.

The new insurance system was financed by premium contributions from both the employer and the employee. The employer on average contributed 6 percent of employees' wage and the employee contributed 2 percent of his wage (Liu 2002). Retirees were exempt from the premium contributions, and the cost of their contributions was borne entirely by their former employers. Moreover, for the laid-off employee, his previous employer was responsible for paying the premium contributions. BIS financed beneficiaries' health care services through three tiers: the individual medical saving accounts (MSAs), the out-of-pocket spending by beneficiaries in the form of deductibles, and the social risk pooling. As we introduced before, the total premium contribution was equal to 8 percent of the employee's wage. The total contributions were divided into two accounts, where 3.8 percent went to the MSAs, which could be used for health care expenditure; the rest 4.2 percent went to the social risk pool fund (SRP), which could be used to cover large medical expenses. The category of large medical expense was defined by the city government.

In BIS, the employee, who contributed the premiums, was expected to pay all of the outpatient medical expenses out of the MSAs until funds have been depleted. The unused MSAs funds could be carried out over to the next year, and the unused funds

at the end of a person's life became a part of his bequest. If the MSAs funds exhausted, the employee had to pay outpatient expenses out-of-pocket. If the employee incurred inpatient expenses, he had to pay first a deductible that equal to 10 percent of his annual wage. Expenses exceeding this deductible were paid by SRP, but the patient paying a coinsurance, the rate of which was decided by the local government. SRP limited the payment for each patient to four times of the average wage of the employees in that city. However, if the inpatient expenditure exceeded this ceiling, the patient had to pay the rest fees out-of-pocket (Liu 2002). In addition, there were supplementary insurance schemes available, including the government supplementary insurance, private insurance.

1.3.1 Health Care Reform and Saving Decisions

To the best of our knowledge, there is no study to explore the relation between the 1998 health care system reform and households' saving decisions. However, since a large part of this reform consisted on the reform of the insurance system, which largely affected the households' out-of-pocket expenses and potentially savings due to the precautionary motives.

Since many SOEs were bankrupt and their employees were became uninsured, there was a significant decline in the population covered by LIS and GIS at the beginning of 1998 (Gao et al. 2001). They find that the proportion, who had to pay for medical service out-of-pocket increased from 28 percent in 1993 to 44 percent in 1998. In addition, they document that among those in the lowest income group who reported illness but did not obtain the treatment of any kind of health service, nearly 70 percent in 1998 claimed financial difficulty as the major reason. They conclude from the data analysis that access of the urban population, particularly the poor, to formal health services has worsened and has become more inequitable since the early 1990s. Two main possible reasons for this trend were the rapid rise of

per capita expenditure on the health services and the decline in the public insurance coverage. Some studies were to examine the trend of hospitalization among the elderly in urban China and analyze the main socioeconomic factors affecting the use of the inpatient services (Gao, Raven and Tang 2007). The authors find that the elderly with insurance are more likely to use inpatient services than those who were not insured. The financial difficulty appeared to be the most common reason for not accessing inpatient care, particularly for the elderly without health insurance. They also suggest that appropriate policies could be developed to protect the people that without insurance from high health care expenses.

Some studies consider the health risk effect on the households' saving decisions (Chamon and Prasad 2010). The authors measure the health risk by constructing a dummy variable, which takes the value unity if the fitted probability (from a probit estimation) of a large health expenditure exceeds 10 percent. They find that the health risk dummy has almost 20 percentage point effect on the saving rate. When considering the effect of the health risk on the saving rate, they find that an older household for which the risk is present will still save 5 percent more of its income than the younger household. The households having the health risk account for only 0.2 percent in the 1992-1996 sample, 8.0 percent in the 1997-2001 sample, and 16.8 percent in the 2002-2005 sample. These findings explain why the inclusion of that control the health risk dummy effect on elderly savings in different periods. The health risk can partially explain why saving rates for elderly households are increasing from the 1990s to the 2000s.

1.4 Pension Reform

In this section we want to discuss the pension reform effect on households' saving decisions. The pension reform was an important pillar of Chinese social security

reform and it might change the structure of the social security system. The structure of the new pension system might have impacts on households' saving plans of their whole life. However, in different periods, the pension reform offered different pension provisions, and all studies consider the pension reform in 1997 for the SOEs employees. Besides introducing the institutional background of the 1997 pension reform, we also provide a historical point of view of the pension reform starting from the 1980s.

Prior to 1989, the authorities published provisional regulations which required the SOEs employees to contribute up to 3 percent of their wages towards their pension schemes. Along with the employees' contributions, SOEs contributed 15 percent of payroll. During this period, the pension provisions were run on the SOEs basis, and pension assets pooled and distributed in each SOEs. In 1991, the Chinese government decided to deepen its reform with the main objective of establishing a multi-pillar system, which was more able to cope with the ageing population. The first pillar was managed on a Pay-as-you-go basis since the "No. 33 State Council Resolution on Pension Reform for Enterprises Employees (MOLLSS 1999)" noted that the amount of pension asset collection in a single year should be based on the estimated pension payout of the same year. Besides the first pillar, the No. 33 Resolution encouraged the establishment of second and third pillar. The second pillar was enterprises based and required contributions from both employers and employees, and the third pillar served as a complementary saving account with contributions from employees only. However, neither the second nor third pillar was compulsory.

In 1995, the government issued "Circular No. 6 State Council Resolution on Deepening Pension Reform for Enterprises Employees". It introduced two pension reform packages to municipal and provincial authorities. Both packages were related to the first pillar of the pension reform. The first package specified that the employees should contribute at least 3 percent of wages to their accounts, and the contribution should increase by one percent every two years until it reached 5 percent. In addition,

enterprises were expected to contribute 11 percent of payroll (Hu 2006). Regarding the second package, specifications of the contribution sharing between the enterprises employees and their employers were not made and left with the local authorities to decide. The original intention of allowing municipalities to choose these two or to mix them was justified, but in practice it led to the creation of hundreds of incompatible schemes across China (World Bank 1997). This was largely due to the local government's attempt to differentiate its scheme from others in order to maximize its own benefits (Hu 2006).

In 1997 a milestone pension regulation, i.e. "State Council Document No. 26 Establishment of a Unified Basic Pension System" for enterprises employees, was published. The regulation - largely influenced by recommendations from the World Bank (Friedman et al. 1996 and World Bank 1997) required the establishment of a multi-pillar system. Based on the new model, China should establish a unified pension system by 2000 on a national basis. The system should cover all the employees working in cities and towns, regardless of the ownership of the enterprises or the organizations to which the employees were affiliated. The new pension reform covered not only the SOEs employees, but also those employees in other public sectors. In the new model, there was a Pay-as-you-go pillar, in which the enterprises wholly contributed 17 percent of the employees' wage. The replacement rate was 20 percent. The other important pillar of the 1997 pension reform was organized as individual accounts, which required 8 percent of enterprises' contribution and 3 percent of the employees' contribution. The employee's contributions were planned to increase by 1 percent every 2 years until they reach 8 percent. The replacement rate of this employees' contributions was 38 percent. In addition, both the Pay-as-you-go pillar and the employees' contributions were compulsory, and the target replacement rate was 58 percent, i.e. 20 percent from Pay-as-you-go pillar and 38 percent from the

employees' contributions. However, funds accumulated in employees' contributions were frequently used to pay current retirees' pension (Hussain 2002).

The fully qualifying years for a basic pension were 15 years. If an employee had a contribution history of less than 15 years, the employee was entitled to the payment from the employees' contribution. In other words, the employee only had a replacement rate of up to 38 percent. In addition, regarding investments, the 1997 pension reform document made it very clear that all surpluses in Pay-as-you-go pillar and the balance in employees' contribution should be invested in bank deposits and government bonds only. Pension funds should be strictly forbidden to invest in any other financial instruments, such as stocks. Last, it is worth noting that all these pension reforms initiated in China, as we discussed above, superseded each other, i.e. the old reform was always replaced by the new ones once the authorities introduce the latter.

1.4.1 Pension Reform and Saving Decisions

The main objective of the pension reform occurred in 1997 was to establish a mixed mechanism of the Pay-as-you-go and the employees' contribution system. The mixed mechanism would reduce the household saving rate after retirement (Feldstein 1999). Although the Chinese household saving rate is so high, it could be induced by other social security reform. Unfortunately, the author fails to analyze the determinants that result in a higher Chinese household saving rate. When considering the macro data, the relation between the pension reform and households' saving decisions is not statistically significant (Kraay 2000).

Using the household level micro data, studies find the positive and significant relation between the pension reform and the household saving rate (Ma and Yi 2010). However, pension reform-related upward pressure is unlikely to compensate for the downward pressure coming from a growth slowdown and demographics. One contri-

bution uses the exogenous-policy induced-variation in the pension wealth to estimate explicitly the impact of the pension wealth on households' savings, and obtain the evidence of a significant offset effect of pension wealth on household savings. Although the size of the effect depends on the parameter values that are assumed, the finding that households' savings are affected by the pension reform is robust. Moreover, the estimation results indicate that the pension reform boost the household saving rate in 1999 by about 6-9 percentage for cohorts aged 25-29 (Feng et al. 2011). These results are consistent with the findings by Chamon, Liu and Prasad (2010). The authors use a panel of urban Chinese households to show the pension reform has led to a reduction in pension replacement income relative to average wages for employees retiring after 1997. This cut in the pension replacement ratio can also help to explain rising saving rates, particularly for households with older household heads approaching retirement, such households have less time to adjust to the change in pension benefits and must therefore build up an adequate level of saving more quickly. Besides the pension reform, they also document a sharp increase in income uncertainty. While the permanent variance of the household's income is stable, the transitory variance rises sharply. The income uncertainty on younger households and the pension reform effects on old households can partially explain the Chinese U-shape age-saving profile.

1.5 Conclusion

From the end of the 1970s, China has launched its reforms in the economic sector and the social security system, including the housing system , the health care system, the pension system, etc. The economic reform brought about uncertainties in the future income, which induced the households to have precautionary saving to protect the future uncertainty.

After the housing reform, the household saving rate is higher. The housing reform increased the home ownership in urban China. Home owners have the higher saving rate than households that do not have any private houses, particularly those who brought in the market after the reform. These findings confirm that home owners have strong saving motives to improve the quality of the housing stocks. However, the existing contributions fail to consider the endogeneity problem induced by the home ownership.

For what concerns the health care reform, studies find that after 1997 the beneficiaries of the public insurance have higher out-of-pocket expenses, which may induce them to have strong saving motives. In addition, the households with health risk are more likely to save more. According to our knowledge, there are no studies to explore the relation between the health care reform and the household saving rate.

The pension reform did change the household's life-cycle saving plan. Studies find that the positive and significant relation between the pension reform and the household saving rate, especially for the households, who are closing to the retirement. The pension reform has led to a reduction in pension dependency ratio relative to average wages, which can help to explain the rising of the saving rate.

Although the causes of the Chinese households' saving decisions are complex, the housing reform, the health care reform and the pension reform are likely to affect the households' saving decisions.

Chapter 2

Household Saving and Reform of Housing Finance System in Urban China

2.1 Introduction

The characterization of the determinants of households' saving decisions is essentially important both for providing a framework capable of explaining the wealth accumulation and for a wide variety of policy issues. Given the large size of the Chinese economy and the importance of the household sector, considerable research has been devoted to understand Chinese households' saving decisions. A number of early studies applied classical models of saving, which are originated from the studies of saving behavior in a developed market economy. The famous models, such as Keynesian hypothesis, Modigliani-Brumberg's life-cycle theory, and Friedman's permanent-income hypothesis are taken into account to emphasize the Chinese household's saving behavior. However, these results predicted by these theories are not supported by empirical studies on the saving behavior of Chinese households (Chow 1985, Qian

1998, Wang 1995, and Modigliani and Cao 2004)¹. For example, one challenging fact that hardly reconciles with the life-cycle theory is that, instead of consuming more to smooth lifetime consumption, Chinese households continued to save in anticipation of higher future income. The empirical evidence of the age-saving profiles of the Chinese household is puzzling as it shows a U-shaped pattern (Chamon and Prasad 2010, Brugiavini, Weber and Wu 2010, and Yang, Zhang and Zhou 2010), which is inconsistent with the hump-shaped pattern predicted by the life-cycle hypothesis.

Another branch of the empirical literature focuses on effects of policy interventions on households' saving decisions. In this paper, we concentrate on the effect of one pillar of the Chinese reforms, called the housing finance reform, on the household saving decisions. Before that, it is relevant to have an overview of the Chinese reforms and their effects on the household savings. At the end of the 1970s China started its reforms in several domains: economic sector, housing, pension, education, health care, etc. The reforms aimed to transform China's stagnant, impoverished central planned system into a decentralized system capable of increasing well-being of the Chinese citizens. The economic reforms brought about a rapid growth of the urban household's disposable income and in response the households' saving rate increased in recent years. The average saving rate of urban households relative to their disposable income rose from 17 percent in 1995 to 24 percent in 2005 (Chamon and Prasad 2010). The reforms of public provisions of education and health care system lead to an increase of private expenditures. For example, expenditures on health care and education only accounted for 2 percent of household's consumptions in 1995, but this share rose to 14 percent by 2005 (Yang, Zhang, and Zhou 2010). Some studies use panel data and find that the pension reform can partially explain the U-shape age-saving profiles (Chamon, Liu and Prasad 2010). The authors find that the change in the dependency ratio induces a substantial increase in saving, particularly when

¹Modigliani and Cao 2004 suggest the demographic changes could explain the Chinese household's saving puzzle.

the households' heads are close to retirement.² Their findings suggest that after the pension reform occurred between the 1990s and the 2000s, the households need to save more in order to attain the same level of post-retirement consumption as in the pre-reform scenario. Moreover, the older the household head, the less time there is to adjust the life cycle saving to the lower replacement ratio. These results confirm findings that the pension reform boosted household saving rate in 1999 by about 6-9 percentage point of age group 25-29 and about 2-3 percentage points age group 50-59 (Feng et al. 2011).

In this paper, we consider the Chinese housing reform and focus on its third stage occurred in 1999. Before the housing reform, the urban housing stock was regarded as a welfare good instead of a productive investment and received lower priority compared with factory buildings and industry centers (Song, Chu and Chen 2004). Urban Chinese employers could obtain housing-construction funds from the government, and were responsible to construct the welfare public dwellings to their permanent employees, charging a symbolic fee, which was even lower than maintenance costs. The employers were in charge of the maintenance burden and had lower and lower incentive to construct new dwellings for their employees. Most urban workers were reluctant to get public houses from their employers and the urban houses were overcrowded. The housing reform became a pillar of the Chinese reforms in 1979. The overall objective of the housing reform was to establish a functional housing market so that the urban households could purchase houses directly from the market and the employers would be relieved of their housing responsibility. At the beginning, the scale of the housing market was limited. Besides developing the housing market, China also started to privatize the existing public housing stock in order to alleviate the maintenance burden for the employers.

²The dependency ratio refers to the change in the demographic composition.

The first stage of the housing reform started in 1980. Between 1980 and 1987, several experiments were carried out to test the feasibility of various public housing reform measures, such as rising rent fees and privatize the existing housing stocks in some selected areas (Wang and Murie 2000). In 1988, the central government issued the regulatory document “The Implementation Plan for a Gradual Housing System Reform in Cities and Towns”, which marked the beginning of the establishment of a nationwide housing market and public housing units throughout the country started to be sold to their sitting tenants at heavily discounted prices.³ The households did desire to purchase the public houses for two reasons: first, there was a disadvantage in the financial investment, the households mainly invested via bank deposit associated with the low interest rate. Although they were looking for other channels, the financial market was underdeveloped; second, durable goods, such as color TVs, houses, have often been used as effective means of recalling surplus currency out of circulation by the government to ease the inflation pressure (Aaberge and Zhu 2001). However, the gap between the house prices and the household’s income did exist and the commercial mortgage market was not fully established. The Chinese government realized that it was necessary to implement the housing finance system reform.

The second stage of the housing reform started in 1994. The Chinese central government in 1994 issued the regulatory document “The Decision on Deepening the Urban Housing Reform”, which emphasized that the key point of the housing reform in the next stage was to implement the housing finance reform. The housing finance reform included not only the establishment and enhancement of the commercial mortgage market, but also the establishment of a dual national housing saving programme, which combined both social savings and private savings. This dual na-

³Constrained by the Chinese personnel and file system, the welfare-oriented public housing distribution system is only offered to the permanent employees. The discount prices were determined according to the employee’s work years, occupational rank, etc.

tional housing saving programme was called the Housing Accumulation Fund (HAF).⁴ After the housing finance reform, potential home buyers would apply for commercial mortgage loans offered by commercial banks, or they could get subsidized mortgage loans through HAF.⁵

The third stage of the housing reform began in 1998. The objective of this stage was to cut links between the employers and the housing provision (Deng, Shen and Wang 2009). In 1998, the central government issued the regulatory document “A Notification from the State Council on Further Deepening the Reform of the Urban Housing System and Accelerating Housing Construction”. It prevented the employers from building or buying new housing units for their employees. Instead, the employers were required to provide cash subsidies to their employees via HAF. On the housing market side, after 1998 the market mechanism was established in supplying sufficient housing productions. Potential home buyers could solely purchase houses from the market.

The objective of HAF was to help urban households to purchase houses. HAF, as a partial package of the housing finance reform, might have a twofold effect on saving. It had an indirect effect on the decision to own a house or on the intention to purchase a house in the future. It might have the direct effects on saving that could be both positive and negative. On the one hand, HAF might work as an alternative source of finance because it allows to access loans with a lower interest rate. In this case, the effects of HAF on saving might be negative. On the other hand, HAF might also work as a way to motivate the accumulation of financial sources to purchase houses. In this case, the effects of HAF on saving might be positive. The home ownership is endogenous, since the privatization of the public housing stock

⁴Some of the contributions refer to Housing Provident Fund. Both names, Housing Accumulation Fund and Housing Provident Fund appear in the official and unofficial documents. Here we use the former.

⁵Potential home buyers in the second stage of the reform could either purchase the market houses or buy the public houses sold in the reform.

motives urban households to purchase household in the reform (Chamon and Prasad 2010), and the gradual development of the housing market also has impact on the home ownership. It is somewhat surprising that little empirical evidence exists on the relation between HAF and the saving rate, as well as the relation between HAF and the home ownership. In this paper, we would like to provide some empirical evidence of these two relations.⁶ The remainder of this paper is organized as follows: in Section 2, we introduce the institutional background of the housing finance reform carried out between 1994 and 1999. Section 3 presents the description of the data set used in the empirical analysis and some stylized facts. Section 4 provides an estimation model and the main results. Finally, Section 5 concludes.

2.2 Institutional Background

The housing finance reform and the public housing stock privatization were two important components of the housing reform. The housing finance reform mainly aimed to sustain the public housing privatization process, as well as the development of the housing market. One study traces much of the increase in saving rates among young households motives of saving for home purchase (Chamon and Prasad 2010). As we introduced before, HAF was expected to have direct effects on the home ownership. Part of the household saving is motivated by the intention to buy a house, so HAF, affecting the way a household might have access to the housing market, also affects their intention to save. In this section, we will review the institutional backgrounds of the housing finance reform, as well as relations among the housing finance reform, saving rate, and the home ownership.

⁶Household i 's saving rate: $sr_i = 1 - \frac{\text{household's expenditure}}{\text{household's disposable income}}$. According to Brugiavini and Padula (2001) and Brugiavini and Weber (2003), disposable income traces HAF contributions and contributions to other social security items as taxes. The amount of HAF contributions is excluded from the disposable income. The household expenditure includes the expenditure on food, clothing, communication, transportation and housing related issues. The housing related issues include the rent fee, the fee of water and electricity, whereas home purchase fee is not included in.

2.2.1 Reform of Chinese Housing Finance System

In the second stage of the housing reform, the Chinese central government started its housing finance reform, which aimed to decentralize the funding investment for housing development, for example, by mobilizing the resources from the employee and the employer as well as introducing financial leverage through intermediaries such as commercial banks (Zhang 2000). The housing finance reform induced the establishment of the dual saving program HAF and the enhancement of the commercial housing mortgage market. In the following of this section, we review them separately.

Housing Accumulation Fund

Similarly to the Singapore Central Provident Fund (CPF) experience, Shanghai in 1991 firstly started to launch HAF, in which the employer, the employee, and financial institutions were involved. Encouraged by the Shanghai successful experience, the central government expanded the HAF programme nationwide in 1994, and authorized the HAF administrative affairs to each municipality or province. Each municipality or province was required not only to establish a HAF management department to supervise and manage HAF, but also to issue the local HAF administrative document. The local document in general identified the HAF collection, usage, etc.

Between 1994 and 1999, the local HAF management department has encouraged local employers to institute HAF. The employers still had the right to decide whether to institute or not, according to their economic situations. Once, the employers decided to institute HAF, they created a one-for-one match account for each employee in China Construction Bank (CCB), into which both the employee and its employer deposited a fixed percent of the employee's wage.⁷ The government agencies, the

⁷Still, constrained by the personnel and file system, the employers in general created HAF accounts only for their permanent employees. The deposited percentage varies across provinces. We will argue this issue later. There are four biggest state-owned commercial banks, which are: Industrial and Commercial Bank (ICBC), Bank of China (BOC), China Construction Bank (CCB), and Agriculture Bank of China (ABC). They are all supervised by the People's Bank of China.

public institutions and the state-owned enterprises (SOEs) in a profitable situation were most encouraged/required to institute HAF, whereas SOEs in a non-profitable situation and private firms were less encouraged/required (Song and Zhang 2009). The employee had to contribute to HAF if his employer has instituted it; whereas he could not contribute to HAF individually if his employer has not instituted it.⁸

The employers who instituted HAF and the HAF contributors could benefit from HAF. The employer who instituted HAF could apply for subsidized loans to construct new houses for their employees, while the HAF contributor was expected to apply for the HAF subsidized loans to purchase public houses and market houses.⁹ Both HAF loans applications submitted by the employer and the employee had to be approved by the local HAF management department.¹⁰ Besides the home purchase activity, the HAF loans can also be used for other housing-related activities such as the home improvement, the housing repair and the self construction. One critical issue that should be mentioned was, besides the qualified house related purpose, the employee can withdraw the remaining savings in HAF account if he has retired and has already finished repaying the loan and its interest for buying a house.

Since the employers were encouraged but the institution of HAF was not compulsory, there were variations of the contribution rate among provinces. The contribution rate was as high as about 90 percent in Jiangsu and Zhejiang provinces and around 98 percent in Shanghai. However in most provinces it was lower than 50 percent (Zhang

⁸HAF was a pillar of the Chinese social security system and the social security tax was compulsory and levied as the personal income tax. The employer levied the employee's HAF contribution according to his/her monthly income, then deposit both the employer's and the employee's contributions in CCB. The employee's monthly wage was his monthly gross income minus his income tax and all the social security taxes.

⁹The HAF subsidized loan means the rate of HAF loan is always less than the commercial loans. HAF made profit to grant subsidized loans to households, since the interest of the loans is higher than the interest of the bank deposits. For example, the annual HAF loan rate determined by PBoC in 21st Feb were 3.60 percent for less than 5-year term and 4.05 percent for more than 5-year term; the rate of the commercial loans were 5.04 percent for less or equal to 6-month term and 5.76 percent for more than 5-year term; while the bank deposit was 2.79 percent for 5-year term (People's Bank of China 2002).

¹⁰One study uses a life-cycle model to show that the optimal time for an employee to apply for the HAF loans is 10-15 years after his HAF contribution (Buttimer, Gu and Wang 2004).

2000). Furthermore, the percentage of HAF contributions of the employer and the employee determined by the local HAF management department also varied across cities. Some provinces required both the employer and the employee to contribute 5 percent of the employee's wage, while most cities required a rate of less than 5 percent. This heterogeneity generally depended on the domestic economic situation (Editorial Committee of the Yearbook of China Real Estate Market 1997, Liang 1998, and Wang et al. 1999).

On March 17th 1999, the 15th Executive Meeting of the State Council issued the regulatory document "Regulations on Management of Housing Accumulation Fund", which provided the national and unified HAF provisions. The new provisions specified the HAF management, usage, etc., which were similar to the old provisions issued by each province in 1994. The HAF management and the loan approval right still belonged to each local HAF management department and the central government only supervised them. However, in the same year, the employers were prevented to construct and sell the public housing stocks to their employees. Instead, they had to provide housing subsidies to their employees via HAF. The 1999 regulatory document has emphasized that: first, both the employer and the employee had to contribute at least 5 percent of the employee's wage; second, all the employers and the employees had to contribute to HAF and the employers would be punished if they failed to institute. Unfortunately in practice, this penalty was not strictly enforced, since the local HAF management department was often reluctant to punish local business owners. There were 80 million workers and staff registered in 2004, and about 60 million workers made regular contributions to HAF funds. Whereas, the rest 20 million workers did not contribute, due to financial difficulties of their employers. It should also be mentioned that only those workers who signed employment contracts for one year and longer were required to contribute. On the contrary, temporary

workers and laid-off persons were still not included in the HAF system (The Chinese Ministry of Construction 2005).

The Chinese government took great pride in the success of accumulating housing savings in HAF. As the fund grew, one critical challenge facing the HAF system involved the fund investment. Since the objectives of HAF were to support the individual contributors' qualified proposes and to provide subsidized loans, HAF had to ensure that sufficient capital was available to meet these demands. With this principle in mind, it is relevant to consider how to invest the extra fund. The fund could neither be invested in the stock market, nor be used to support any housing market activities, such as providing loans to commercial housing projects. Indeed, the main option was to invest in Chinese Treasury Bonds, which alone cannot meet investment needs of rapidly growing funds (Deng, Shen and Wang 2009). In 2007, an estimated 200 billion Yuan (equivalently 60.61 billion US dollar in 2011) was still deposited in banks because of lack of other good financial investment options (The Ministry of Housing and Urban-Rural Development of China 2009). Only recently the Chinese government has been looking for new options to expand HAF investment cautiously. For example, in 2009 the Chinese government has started to test the feasibility of investing the funds in Cheap Rental Housing (CRH) projects in form of providing low interest loans (Deng, Shen and Wang 2009).¹¹ Investing in CRH project could be a mutually beneficial option: for the local HAF management department, investing in CRH could earn a higher interest rate than lending to the households; for the CRH developer, the HAF investments required a lower interest rate than that of the commercial bank loans.

¹¹CRH project is a programme to construct public houses and to rent them to urban households whose income is lower than a certain level. It was a social security project but not a commercial housing project.

Commercial Housing Mortgage

Commercial banks were also involved in the housing finance reform. In 1994, as part of the housing finance reform package, the Chinese government started to introduce commercial housing mortgage loans to home buyers nationwide (Di et al. 2008). Initially, the commercial banks often imposed strict restrictions on the loan origination. For example, the housing mortgage loans were available only to those who have bank deposits at least equal to 20 percent of total house values. Moreover, the loans had to be repaid in 5 years and the down payment must be no less than 30 percent. Most urban households could not meet these criteria (Zhang 2000). As a consequence, the housing mortgages remained only a small portion of total bank loans. In June 1998, the commercial household's housing mortgage loans were 35 billion Yuan (equivalently 11.30 billion US dollar in 2011), which accounted for 13 percent of total housing loans. However, starting in 1998 links between the employers and the housing provision were cut, potential urban households had to purchase houses from the market (Han 1999). To support the policy intervention, the People's Bank of China (PBoC) published the regulatory document "Residential Mortgage Lending Regulations", which established basic mortgage lending standards, such as extending maximum mortgage term of 30 years and a minimum down payment ratio of 30 percent (Deng, Shen, and Wang 2009). PBoC also regulated the preferential mortgage interest rate and set the mortgage rate 10 basis point below the benchmark interest rate with the same terms. These relaxed lending standards, coupled with the strong housing demand released by the housing reform, have led to an unprecedented growth of the commercial mortgage sector (Deng and Fei 2008).

The biggest four state-owned commercial banks ICBC, BOC, CCB, and ABC dominated the primary mortgage markets. Together they accounted for over 90 percent of the commercial housing mortgage market share (Deng and Liu 2009). The authors also mention that there was no risk-based pricing mechanism in the Chinese

mortgage system. Instead, PBoC set the mortgage rate, the minimum down payment ratio, and the longest term, which served to all borrowers. Although PBoC set the maximum mortgage term could go up to 30 years long, the typical term was about 15 to 20 years long (Zhu 2006). Interestingly, the commercial banks have realized that the housing mortgage offered them healthier lending opportunities, since the default rate was much lower than that of the project loans to SOEs. The mortgage rate was not always constant and was adjusted by PBoC according to the Chinese economic situation. Once PBoC announced a rate adjustment, the new rate was applied to all existing mortgage loans starting from the beginning of the following year (Deng et al. 2005). Chinese mortgage borrowers were sensitive to the increase in mortgage rate, so when PBoC announced a rate increase, many borrowers chose to prepay their mortgage loans ahead of the term, especially since they had limited alternative investment opportunities (Deng, Shen, and Wang 2009). In 2006, more than 35 percent of the home buyers paid back their loans ahead of the term (Yang and Shen 2008).

Unlike the mortgage market in developed countries, China has not yet developed its secondary mortgage market. The Chinese government, especially PBoC has long been concerned about the stability of its housing market and the safety of its financial institutions. For example, from 1998 to 2002, PBoC lowered the mortgage interest rate five times to encourage home purchases. This policy did work. From 1997 to 2005, the amount of the annual housing investment in China has increased by about 6 times. This boom was also accompanied by unprecedented home purchase activities. In fact, as early as 2002, PBoC issued a document warning that all the state-owned banks to be careful about potential housing bubbles (Ye and Wu 2008). PBoC also emphasized that the zero-down payment mortgages were strictly forbidden.

Two Housing Mortgage Schemes

The household can face two housing mortgage schemes: the HAF subsidized mortgage if any household members are HAF contributors and the commercial housing mortgage. There are some differences between the HAF mortgage and the commercial housing mortgage. In the commercial housing mortgage sector, the availability of mortgage capital, the rate and its term are determined by the commercial banks and strictly monitored by PBoC. However, the HAF mortgage rate is determined by PBoC, and the local HAF management department has no control over it. The local HAF management department is responsible for approving the HAF mortgage loans and has used it as a vehicle to maintain the prosperity of the local real estate market (Chen 2009). For example, under the pressure of the international financial crisis in 2008, many local governments relaxed the requirement of HAF loans through measures like raising the loan size to promote local housing consumption.

The HAF home purchase loans offered to the households have performed extremely well. The overall average HAF loan default rate was about 0.07 percent in both 2006 and 2007. Clearly, much of this was due to the subsidized interest rate, which could be as much as one percentage point lower than the commercial mortgage rate (Deng, Shen, and Wang 2009). Although the contributors can expect to get a loan that is as much as 10 to 15 times larger than their accumulated amount of HAF, it may not be sufficient to purchase a house. At the same time, they can apply for the commercial housing loans (Wang 2001, Deng and Fei 2008). The total HAF loan origination reached about 380 billion Yuan (equivalently 115.15 billion US dollar in 2011) in 2006, about one-fifth of the total commercial mortgage loan origination (The People's Bank of China 2007). Finally, we should notice that the low-income families were reluctant to get sizable HAF loans, since 10 to 15 times of their accumulated amount of HAF was still much less than the house value (Chen 2009).

2.2.2 Housing Finance Reform, Home Ownership, and Saving Rate

In this section we want to review the existing studies on the relations among the housing finance reform, the saving rate and the home ownership.

Some descriptive statistics shows that the home ownership rate has increased gradually between 1994 and 2002, a change mainly due to the housing reform (Chamon and Prasad 2010). Owing to both the massive public housing privatization and strong government incentives for home purchase, the home ownership rate in China reached 80 percent in 2004; in fact, houses have become the most important new form of private property for urban Chinese households (Feng 2003). Still, the impact of the housing finance reform on the home ownership is not clear. Especially for the HAF contributors, the subsidized housing mortgage may motivate them to purchase houses. To the best of our knowledge, there does not exist any empirical study to test the relation between the HAF contribution and the home ownership. Only one descriptive analysis shows that the HAF contributors tend to purchase larger homes and enjoy more living space per person than other homeowners (Duda et al. 2005).

There exist some contributions that study the relation between the home ownership and the saving rate. Home owners saved more, particularly those who brought in the market after 1999 (Brugiavini, Weber and Wu 2010). This result is consistent with the need to improve the quality of housing stock or move up the housing ladder (Chamon and Prasad 2010).

Since the institution of HAF is an important package of the housing reform, it is relevant to examine the relation between HAF and the saving rate. According to our knowledge, no empirical evidence exists on this relation. Since the Central Provident Fund (CPF) in Singapore is the benchmark of HAF, we want to review the CPF effect on the households' saving decisions' in Singapore. Although CPF was originally intended as an old-age retirement scheme, its role was extended to permit

the withdrawal of savings for the purchase of government housing stocks (Vasoo and Lee 2001). An empirical analysis for the period 1974-1983 finds that compulsory CPF savings have negatively affected voluntary savings (Wong 1986). Similarly, the other study using the sample period 1971-1980 finds out the same results (Wee and Han 1983). However, for the period 1966-1979, there does not exist empirical evidence to support the negative impact of CPF savings on the voluntary savings in Singapore (Loh and Veall 1985). By using the ratio of voluntary saving to GDP derived from national income accounts as the dependent variable in a regression model, the empirical analysis finds that the voluntary saving to GDP was positively related to disposable income and negatively related to the CPF savings in a statistically significant manner (Lim Chong-Yah et al 1988). However, the CPF contributed to increase aggregate savings in Singapore by about 4 percent of GDP during the 1970s and the 1980s (Monetary Authority of Singapore 1991 and World Bank 1993). There is a negative relationship between non-CPF private savings and increases in the CPF savings (Husain 1995). The level of CPF savings has the overwhelming positive impact on nominal savings in real terms in Singapore in the long-run (Wickramanayake 1997).

2.3 Data and Stylized Facts

The availability of the Chinese urban household data is limited. One option of the micro household data is the Chinese Household Income Project Survey (CHIPS), which is collected by the Chinese Academy of Social Science. The data collection consisted of two distinct samples of urban and rural populations of China, selected from a larger sample drawn by the Chinese National Bureau of Statistics. In our analysis, we are concerned about the urban samples. CHIPS is based on a survey of urban households in 11 provinces and municipalities and there are three waves

available, for 1988, 1995 and 2002.¹² CHIPS can provide a snapshot of the Chinese economic situation.

The purpose of CHIPS urban data set is to measure the distribution of personal income in urban area of China. There are two components in the data files: one in which the individual is the unit and the other in which the household is the unit. There is complete information on each household member's social and economic status, including employment characteristics, wage, tax, and other source of income and demographic variables such as, age, gender, relationship to household head. Information is also gathered on the household's expenditure and the living condition.¹³ However, on 1988, the housing reform was not implemented all over the country and there are too many missing values in income, expenditure, etc. in the 1988 wave, we only take into account the waves in 1995 and 2002. In the following, we provide general information on the relevant variables for the empirical analysis and some stylized facts.

2.3.1 General Information

We first provide general information on some relevant variables for our empirical analysis. For the household saving rate, we adopt the standard definition that we have introduced before. CHIPS provides detailed information on the household's tenure

¹²In the 1988 and 1995 waves, the 11 provinces and municipalities are Anhui, Beijing, Gansu, Guangdong, Henan, Hubei, Jiangsu, Liaoning, Shanxi, Sichuan, and Yunnan. In the 2002 wave, Chongqing municipality is also included. Since it was one city of Sichuan province and became the municipality in 1997, we combine Chongqing and Sichuan together in the 2002 wave. These 11 provinces and municipalities cover all the 6 geographical areas and can reflect the economic situation of China. In 2002, Guangdong ranked the first in GDP and Beijing municipality ranked the first in per capita GDP, whereas Gansu ranked the 25th in GDP over all the Chinese 31 provinces and was one of the lowest per capita GDP all over the country; Liaoning was heavy industry center, where petrochemical industry, machinery manufacturing industry and metallurgy industry occupied 70 percent of total Liaoning gross industrial output value; Henan was the most important agriculture province, where cultivated area ranked the first all over the country (The Chinese Statistical Yearbook 2003, Liaoning Statistical Yearbook 2003).

¹³In the 2002 wave, CHIPS provides two special data sets which investigate rural-to-urban migrant individual and household information. However, such data sets do not exist in the 1988 and 1995 waves. We will not take these rural-to-urban migrant households into account in our analysis.

choice. There are four kinds of the tenure choices (living in): rented public house, rented private house, purchased, self-built or inherited house. For simplicity, let us denote the household's home ownership by a dummy variable HO , where $HO = 1$ means the household had a private house, either purchased or self-built or inherited; $HO = 0$ implies household does not have a private house, either renting a public house or renting a private house. In order to understand the HAF contribution effect on the saving rate and the home ownership, we construct the HAF dummy, that takes value 1 if at least one household member has contributed to HAF, and 0 otherwise. More specifically, CHIPS offers the individual accumulated amount of HAF at the end of the survey year, thus we can compute the accumulated amount of HAF at the household level.¹⁴

We restrict the sample to the employed household heads, aged between 25 and 65. We consider the household's composition, such as the household size and whether the household has any children or not; welfare proxies, such as the head's education level and the income; and the employment characteristics, including working years in the current work place, permanent employed or not, working in the enterprises or not, and the economic sector. In practice, we construct the dummy for the permanent employment, that takes value 1 if household head is permanent employed, and 0 otherwise; and the dummy of enterprises takes value 1 if the household head is working in the enterprises, such as SOEs, urban collective enterprises, etc., and 0 if the head is employed by the governments and institutions.

2.3.2 Stylized Facts

In Table 2.1 we report the descriptive statistics of some relevant variables, which are also provided in Chamon and Prasad (2010) and Yang, Zhang and Zhou (2010).

¹⁴In the 2002 wave CHIPS provides the accumulated amount of HAF contribution at the end of 2002. However, the 1995 wave the accumulated amount of HAF is not available. We know that till the end 1995, HAF has implemented for one year nationwide. In 1995, the yearly amount of the HAF contribution can be considered as the accumulated amount at the end of 1995.

Table 2.1: Mean of Variables Existing in Both CHIPS and UHS Subsamples

Variable Name	CHIPS	CHIPS	UHS	UHS	UHS	UHS
Survey Year	1995	2002	10-province 1995	10-province 2002	5-province 1995	5-province 2002
Observations	5161	4476	6297	16607	3727	9813
Saving rate	12.9	20.4	15.2	20.0	16.2	19.5
Home ownership rate	43.0	64.1	30.9	79.5	-	-
Household head's age	42.0	43.4	-	-	45.5	47.9
Household size	3.2	3.0	3.2	3.0	3.2	3.0

Notes: All the values in this table are means. The mean values in the second and third column are computed by ourselves. The saving rate and home ownership rate are percentage. The mean values of UHS 10-province sample is given by Chamon and Prasad (2010) and that of UHS 5-province sample is provided by Yang, Zhang and Zhou (2010).

Both studies use subsets of the Chinese Urban Household Survey (UHS) conducted by the Chinese National Bureau of Statistics. Chamon and Prasad (2010) adopt a 10-provinces subset and report that, by using sampling weights, their sample covers about 45 percent of the total UHS observations. Moreover, there were no major discrepancies between their results and the results of the whole sample of UHS. Yang, Zhang and Zhou (2010) use the other 5-province subset of UHS. Their descriptive statistics is consistent with most of the existing contributions, including Carroll and Hong (2010), and Deaton and Paxon (2000).

We can observe that in the 1995 wave the home ownership rate is already high, which is due to the fact that the privatization of the housing stocks all over the country has been implemented for 8 years. The average home ownership rate increased significantly from 43 percent in 1995 to 64.1 percent in 2002, which is consistent with the finding of Chamon and Prasad (2010). This increment of the home ownership rate is a result of the privatization of the public housing stocks during the reform and sufficient market houses provided after the reform. The saving rate also increased significantly. However, the saving rate suggested by the aggregate data taken from the Flow of Funds is 28.6 for 2002, which is much higher than that in all these three data sets. Discrepancies between micro and macro data on the saving rate are an issue in virtually every country where both types of data are available. This coincides with the finding of Deaton (2005). It documents systematic discrepancies whereby

Table 2.2: Descriptive Statistics of Other Relevant Variables

Panel A: Dummy Variables			
Variable Name	1995	2002	Total
HAF dummy	43.31(0.4955)	65.68(0.4748)	53.70(0.4987)
Dummy of any children	90.20(0.2974)	85.68(0.3503)	88.10(0.3238)
Dummy of enterprises	64.79(0.4777)	59.70(0.4906)	62.43(0.4843)
Dummy of permanent employed	82.56(0.3795)	58.56(0.4927)	71.41(0.4519)
Panel B: Continuous Variables			
Variable Name	1995	2002	Total
Disposable income	5150.08(3012.56)	7930.93(4917.69)	6441.74(4244.34)
Accumulated amount of HAF	51.36(103.21)	1181.69(2040.57)	576.35(1503.22)
Education years	10.86(3.00)	11.28(3.02)	11.06(3.01)
Working years in current unit	17.30(8.94)	16.88(9.79)	17.10(9.35)

Notes: All the values are computed from CHIPS. Standard deviations are in parentheses. For all the dummy variables in Panel A, the means are also equal to the proportion if the dummy variables take value 1. The mean of HAF dummy represents the mean of HAF contribution rate. In Panel B, the disposable income and the accumulated amount of HAF are given in terms of 2011 US dollar. They are computed as follows: first adjust the out-of-pocket expenses in 1995 and 2002 by CPI to the 2011 level; second transfer the out-of-pocket expenses at 2011 level to equivalent US dollar by using PPP. The source of PPP is IMF.

survey based measure of income and consumption are different than those from the national accounts in most countries. Some of these differences can be traced to be definitional issues. For other variables that will be used in the empirical analysis, we offer the descriptive statistics in Table 3.1.

Table 3.1 contains two panels, where Panel A is for dummy variables and Panel B is for continuous variables. We can observe from Panel A that the HAF contribution rate has increased significantly from 43.31 percent in 1995 to 65.68 percent in 2002. This increment is partially due to the HAF compulsory provision established in 1999. Although HAF became compulsory to all the urban employees, the descriptive statistics shows the contribution rate is still far from 100 percent. As we introduced before, in 2004, still 20 million employees over 80 million do not contribute to HAF, owing to the non-profitable situation of their employers. In 2002, the HAF contribution rate could be even smaller. Moreover, CHIPS includes short-term and temporary employees, which are not included in HAF.

In Panel B, we observe that the household's average income increased significantly from 1995 to 2002. This result coincides with the finding of Chamon and Prasad (2010) and is due to the Chinese economic development. The accumulated amount of HAF in 2002 is 22 times more than that in 1995. This substantial growth is due

to two reasons: first, in 1995 the HAF policy has implemented for only one year and was even not compulsory for all the employees, whereas at the end of 2002 the longest HAF contribution term is 8 years and the contribution rate also increased; second since the income-based HAF mechanism implies the amount of yearly HAF contribution increases along with the income growth, thus the accumulated amount of HAF increases, too.

Since our main objective in this paper is to explore the HAF effect on the saving rate and the home ownership, we examine the saving rate pattern and the home ownership pattern conditional on the HAF variable, as well as some stylized facts, before presenting the econometric analysis.

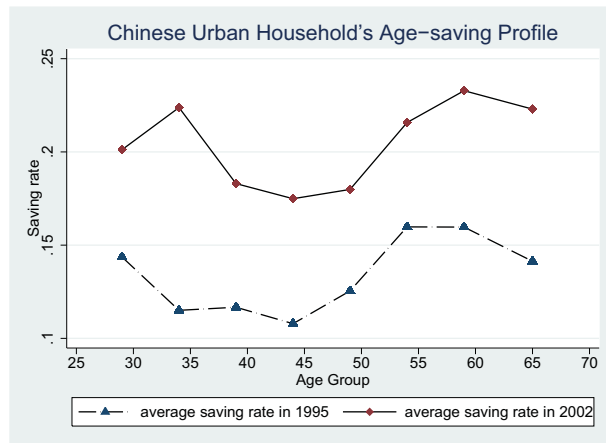
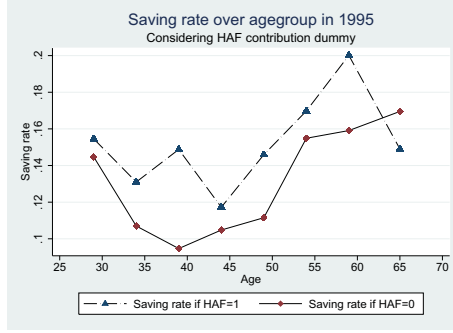
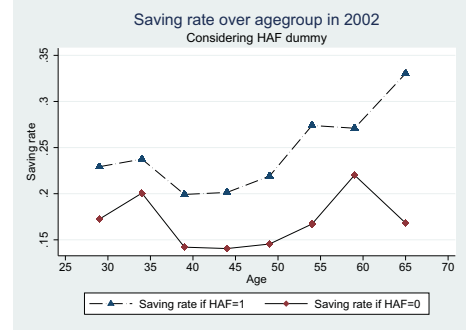


Figure 2.1: The Age-Saving Profile

Figure 2.1 shows the average saving rate over the age group. Clearly, for each age group, the average saving rate is higher in 2002. The age-saving profiles in both the 1995 and 2002 waves have a U-shape pattern. This empirical evidence coincides with findings of Chamon and Prasad (2010), Brugiavini, Weber, and Wu (2010), and Yang, Zhang and Zhou (2010). The younger households have to save for their children's education in the future, and the elderly saves in order to have the same consumption level after the retirement.



(a) The 1995 Case



(b) The 2002 Case

Figure 2.2: The Age-Saving Profile Conditional on HAF Variable in 1995 and 2002

Table 2.3: HAF contribution rate, Home ownership rate, and Saving rate in Different Provinces

Province	HAF Contribution Rate 1995 2002	Home Ownership Rate 1995 2002	Saving Rate 1995 2002
Beijing	45.95 77.06(31.11)	17.02 54.13(37.11)	16.26 14.08(-2.18*)
Shanxi	27.42 55.37(27.95)	35.28 45.76(10.48)	18.68 23.90(5.22)
Liaoning	53.13 66.38(13.25)	17.10 58.13(41.03)	9.20 19.93(10.73)
Jiangsu	66.24 69.27(3.03*)	37.61 55.12(18.51)	15.71 24.06(8.35)
Anhui	32.50 60.00(27.50)	41.39 70.77(29.38)	12.52 22.33(9.81)
Henan	12.89 43.94(31.05)	50.12 56.29(6.17*)	13.76 25.73(11.97)
Hubei	34.18 67.09(32.91)	51.19 76.92(25.73)	12.12 18.25(6.13)
Guangdong	53.73 68.88(15.15)	45.54 63.84(18.30)	11.89 21.12(9.23)
Sichuan and Chongqing	21.78 65.28(43.50)	55.07 69.10(14.03)	7.09 13.36(6.23)
Yunnan	77.43 81.09(3.66*)	71.46 78.49(7.03)	14.28 24.34(10.06)
Gansu	50.72 68.61(17.89)	40.58 72.99(32.41)	13.01 18.93(5.92)

Notes: All the values are computed from CHIPS. The increments are in parentheses. * implies the difference is not statistically significant at 5 percent level.

To be precise, we present the age-saving profile conditional on the HAF contribution variable in 1995 and 2002 in Figure 2.2(a) and 2.2(b). We can observe that the age-saving profile for the households with any HAF contributors in 1995 does not have a clear U-shape, since the households with the heads aged between 35 and 39 saved more than those with the heads aged between 30 and 35. However, in 2002, the age-saving profile for the households with any HAF contributors has the U-shape pattern.

We now turn to the discussion of the HAF contribution effect on household saving rate and the home ownership. In Table 2.3 we report the saving rate, the HAF contribution rate, and the home ownership rate for all 11 provinces in 1995 and 2002.

Table 2.4: Home Ownership Rate over HAF Contribution

	(1)	(1)	(2)	(2)	(3)	(3)
	HAF=1	HAF=0	HAF=1	HAF=0	HAF=1	HAF=0
Observations	2235	2926	2940	1536	5175	4462
Mean	41.57	44.08	72.45	48.11	59.11	45.47
Sta. Dev.	0.4929	0.4965	0.4468	0.4998	0.4916	0.4980
Survey Year	1995	1995	2002	2002	Total	Total

Notes: All the values are computed from CHIPS. We do not provide median value, since the home ownership is a dummy variable and most mean values are less than 50 percent.

The average HAF contribution rate for all the provinces is higher in 2002 than that in 1995. The increments are only around 3 percent in Jiangsu and Yunnan provinces and are not statistically significant. For other provinces this increment is more than 10 percent and significant. The home ownership rate has increased substantially and significantly in all the provinces from 1995 to 2002, except Henan. Still there exists a big difference in the growth rate among different provinces. This difference could be due to the composition of economic sectors. For instance, Liaoning province is the heavy industry center and most enterprises are SOEs, which provide plenty of welfare housing stocks to the employees before the reform. Most employees in Liaoning province purchase private houses during the process of privatizing the public stock. The home ownership thus increased significantly from 1995 to 2002. Henan province is the biggest agriculture province in China but it does not have as many public housing stocks to privatize as Liaoning province. We can also observe that the saving rate in most provinces have increased from 1995 to 2002, except Beijing.¹⁵ We now move to consider the HAF contribution effect on the home ownership and the saving rate in Table 2.4 and 2.5.

In Table 2.4, we can observe that, in 2002 the households with any HAF contributors are more likely to have private houses. However, in 1995 the households without any HAF contributors have the higher home ownership rate, but the difference is not statistically significant at 5 percent level and the p-value of T-test is 0.0699. In

¹⁵The saving rate in Beijing is lower in 2002 but the difference is not statistically significant. The p-value of T-test is 0.3089.

Table 2.5: Saving Rate over Home Ownership and HAF

Panel A: The Whole Sample

	(1)	(1)	(2)	(2)	(3)	(3)	(3)	(3)
	HO=1	HO=0	HAF=1	HAF=0	HO=1	HO=1	HO=0	HO=0
			HAF=1	HAF=0	HAF=1	HAF=0	HAF=1	HAF=0
Observations	5088	4549	5175	4462	3059	2029	2116	2433
Mean	18.18	14.33	19.09	13.19	21.15	13.69	16.12	12.77
Median	20.88	15.71	21.14	15.14	23.67	16.01	17.29	14.39
Std. Dev.	0.2691	0.2616	0.2602	0.2697	0.2668	0.2664	0.2475	0.2724

Panel B: Survey Year 1995

	(1)	(1)	(2)	(2)	(3)	(3)	(3)	(3)
	HO=1	HO=0	HAF=1	HAF=0	HO=1	HO=1	HO=0	HO=0
			HAF=1	HAF=0	HAF=1	HAF=0	HAF=1	HAF=0
Observations	2219	2942	2235	2926	929	1290	1306	1636
Mean	14.11	11.98	14.40	11.73	16.14	12.65	13.16	11.01
Median	16.04	12.90	15.64	13.11	18.34	14.61	14.13	11.43
Std. Dev.	0.2530	0.2361	0.2372	0.2480	0.2508	0.2537	0.2264	0.2432

Panel C: Survey Year 2002

	(1)	(1)	(2)	(2)	(3)	(3)	(3)	(3)
	HO=1	HO=0	HAF=1	HAF=0	HO=1	HO=1	HO=0	HO=0
			HAF=1	HAF=0	HAF=1	HAF=0	HAF=1	HAF=0
Observations	2869	1607	2940	1536	2130	739	810	797
Mean	21.32	18.66	22.66	15.97	23.34	15.51	20.90	16.38
Median	24.67	22.57	25.52	20.74	26.35	19.89	23.18	21.88
Std. Dev.	0.2768	0.2981	0.2710	0.3050	0.2706	0.2865	0.2715	0.3214

Notes: All the values are computed from CHIPS. Columns (1) report the saving rate only considering the HO dummy; Columns (2) report the saving rate only considering the HAF dummy; and Columns (3) report the saving rate combining both HO and HAF dummies. The differences in columns marked (1), (2) and (3) are all significant at 5 percent level.

addition, the home ownership rate increased substantially and significantly from 1995 to 2002, if the households had any HAF contributors; whereas for those that do not have any HAF contributors, the home ownership rate remain almost unchanged.

In all panels of Table 2.5, we report the saving rate conditional on the home ownership dummy in Columns (1), while in Columns (2) we report the saving rate conditional on HAF contribution dummy. We can observe that the mean and median values of the saving rate are higher if the households have private houses independent from the survey year. Likewise, the households save more if they have any HAF contributors. The last four columns of each panel report the saving rate conditional on both the HAF dummy and the home ownership dummy. We find that for a given home ownership situation, the households contributing to HAF always have the higher mean and median values of the saving rate in both survey years. In addition, for the households who contribute to HAF, the saving rate is higher if they have private

houses in both 1995 and 2002. However, for the households that do not contribute to HAF, the saving patterns conditional on the home ownership dummy are different: in the 1995 wave the mean saving rate is 1.5 percent and the median is 3 percent higher if they are home owners; whereas in the 2002 wave, the mean and median values of the saving rate of such households are relatively lower.

2.4 Empirical Estimation

In this section we present the empirical estimation to test the relation between HAF and the saving rate, and the relation between HAF and the home ownership. We first examine the effect of HAF contribution on the saving rate and the home ownership, and second we test the effect of the accumulated amount of HAF on them.

2.4.1 Empirical Model

The aim of this paper is to determine the effect of HAF on the saving rate, as well as the home ownership. As we have already introduced before, the home ownership is endogenous. To solve the endogeneity problem, we use a two-stage estimation procedure introduced by Maddala (1983). The primary interest is the saving rate in the regression function:

$$sr_i = \delta_0 HAF_i + \delta_1 \cdot d_2002sy_i + \delta_2 HAF_i \times d_2002sy_i + \theta \cdot HO_i + X_i \cdot \beta + \varepsilon_i. \quad (2.1)$$

We now discuss the explanatory variables included in Equation (2.1). Since we are concerned about the HAF effect on the saving rate, we take into account the HAF variable in the estimation.¹⁶ Moreover, we add the 2002 year dummy to capture the

¹⁶HAF variable could be either a dummy variable that captures the HAF contribution effect on the saving rate, or the accumulated amount of HAF.

aggregate year effect, where the 2002 year dummy takes 1 if the survey year is 2002 and 0 otherwise. To capture the 1999 HAF policy change effect on the saving rate, we add an interaction term between the HAF variable and the 2002 year dummy. HO_i is the endogenous home ownership dummy. X_i represents the vector of all the other exogenous control variables. Like in most studies on household savings, we make the use of the age of the household head. This is to capture the possibility that HAF has effect on different ages. We also take into consideration the household head's education level and the income. The household's income possibly correlates with the HAF variable and the education level, since HAF is income-based and the education level is a proxy of the welfare condition. We will provide different specifications, one includes the income variable, the other which does not. Moreover, the household's composition, such as the household size and the dummy of any children, is included in the estimation. Since the employment characteristics would also have the impact on the saving rate, we should take into account the household heads' employer, economic sectors, permanent employment, and the working years in the current unit. Finally, we add province dummies in X_i and consider Jiangsu province as the reference point. ε_i is the error term and assumed to satisfy the normal distribution $\mathbf{N}(0, \sigma^2)$.

In the two-step estimation procedure, the household's binary home ownership decision HO_i is modeled as the outcome of an unobserved latent variable, HO_i^* . It is assumed that HO_i^* is a linear function of the exogenous covariates W_i , the HAF variable, the 2002 year dummy, the interaction between HAF and the 2002 year dummy, X_i and a random component μ_i . X_i is exactly the same as that in Equation (2.1). W_i represents the vector of instrumental variables, which are assumed to affect the home ownership but not the saving rate. Following Yoshikawa and Ohtake (1989), we use the average prices of residential house (APRH) at province level and its square ($APRH^2$) for each year, which are assumed to be exogenous, affect the home ownership, but not affect the saving rate. APRH is available in the Chinese

Statistical Yearbook 1996 and 2003.¹⁷ In addition, a theoretical model finds that rising the commercial house price would not affect the saving rate (Wang and Wen 2011).¹⁸ For understanding the results easily, we prefer to use APRH divided by 1000 and $APRH^2$ divided by 10^6 , rather than use APRH and $APRH^2$ directly. μ_i is assumed to satisfy the normal distribution $\mathbf{N}(0, 1)$. Specifically,

$$HO_i^* = W_i \cdot \alpha + \delta_0' HAF_i + \delta_1' \cdot d_{-2002sy_i} + \delta_2' HAF_i \times d_{-2002sy_i} + X_i \cdot \gamma + \mu_i; \quad (2.2)$$

and observed decision is:

$$HO_i = \begin{cases} 1, & \text{if } HO_i^* > 0; \\ 0, & \text{otherwise;} \end{cases} \quad (2.3)$$

$$(2.4)$$

where the covariance matrix of ε and μ is:

$$\begin{pmatrix} \sigma & \rho \\ \rho & 1 \end{pmatrix}.$$

¹⁷The ideal exogenous instruments to be used in the two-step estimation procedure would have been the regulated housing prices. However, we cannot find the regulated prices. Instead, we adopt the average prices of residential house (APRH). Since both the supply-side and the demand-side determine the market equilibrium prices of houses, APRH is not completely exogenous. Now, we only assume that APRH and $APRH^2$ are exogenous variables, and we will test the validity of the instrumental variables after the estimation. The unit of APRH is *Yuan/m²*. The 2002 APRH of each province is available in Chinese Statistical Yearbook 2003. The definition of APRH provided by Beijing Statistical Bureau is APRH=Total sales of houses (Yuan)/The sold floor space (*m²*). These two variables of each province are also available in Chinese Statistical Yearbook 2003. We get exactly the same value provided by using this definition. Moreover, APRH in 1995 is the baseline, and APRH in 2002 in our analysis is adjusted by CPI, which is 100/110.6. The 1995 APRH of each province is not directly available in Chinese Statistical Yearbook 1996, but we compute the it by using this definition.

¹⁸This paper finds that rising house prices can generate an aggregate saving rate of 4.17 percent without considering the Chinese demographic structure; whereas rising the house prices does not affect the aggregate saving rate if the demographic structure is taken into account. In our empirical estimation, the household head's demographic information is included, which means APRH in our estimation may not affect the household saving rate.

We thus rewrite equation (2.1) by combining the HO_i^* effects given by Equation (2.3) and (2.4):

$$sr_i = \delta_0 HAF_i + \delta_1 \cdot d_2002sy_i + \delta_2 HAF_i \times d_2002sy_i + \theta + X_i \cdot \beta + \varepsilon_i,$$

$$if : HO_i^* > 0 (-\mu_i < W_i \cdot \alpha + \delta'_0 HAF_i + \delta'_1 \cdot d_2002sy_i + \delta'_2 HAF_i \times d_2002sy_i + X_i \cdot \gamma);$$

and

$$sr_i = \delta_0 HAF_i + \delta_1 \cdot d_2002sy_i + \delta_3 HAF_i \times d_2002sy_i + X_i \cdot \beta + \varepsilon_i,$$

$$if : HO_i^* \leq 0 (-\mu_i \geq W_i \cdot \alpha + \delta'_0 HAF_i + \delta'_1 \cdot d_2002sy_i + \delta'_2 HAF_i \times d_2002sy_i + X_i \cdot \gamma).$$

Hence,

$$\begin{aligned} \mathbf{E}(sr_i | HO_i = 1) &= \delta_0 HAF_i + \delta_1 \cdot d_2002sy_i + \delta_2 HAF_i \times d_2002sy_i + \theta + X_i \cdot \beta \\ &+ \mathbf{E}(\varepsilon | -\mu < W_i \cdot \alpha + \delta'_0 HAF_i + \delta'_1 \cdot d_2002sy_i + \delta'_2 HAF_i \times d_2002sy_i + X_i \cdot \gamma) \\ &= \delta_0 HAF_i + \delta_1 \cdot d_2002sy_i + \delta_2 HAF_i \times d_2002sy_i + \theta + X_i \cdot \beta + \frac{\rho\sigma\phi(\cdot)}{\Phi(\cdot)}; \end{aligned} \quad (2.5)$$

$$\mathbf{E}(sr_i | HO_i = 0) = \delta_0 HAF_i + \delta_1 \cdot d_2002sy_i + \delta_2 HAF_i \times d_2002sy_i + X_i \cdot \beta - \frac{\rho\sigma\phi(\cdot)}{1 - \Phi(\cdot)}. \quad (2.6)$$

where $\phi(\cdot)$ and $\Phi(\cdot)$ are the density function and the cumulative distribution function of the standard normal evaluated at $(W_i \cdot \alpha + \delta'_0 HAF_i + \delta'_1 \cdot d_2002sy_i + \delta'_2 HAF_i \times d_2002sy_i + X_i \cdot \gamma)$. We define $\lambda = \frac{\phi(\cdot)}{\Phi(\cdot)}$ for further analysis.

The difference in saving rate between $HO_i = 1$ and $HO_i = 0$ is

$$\mathbf{E}(sr_i | HO_i = 1) - \mathbf{E}(sr_i | HO_i = 0) = \theta + \frac{\rho\sigma\lambda}{1 - \Phi(\cdot)}. \quad (2.7)$$

Equation (2.5) suggests the following two-stage estimation procedure. We first get probit Maximal Likelihood estimates $\hat{\gamma}$, $\hat{\delta}'_0$, $\hat{\delta}'_1$, $\hat{\delta}'_2$ and $\hat{\alpha}$ for γ , δ'_0 , δ'_1 , δ'_2 and α . We also compute λ .

Furthermore, we should note that by combining the two equations (2.5) and (2.6), we get:

$$\begin{aligned} \mathbf{E}(sr_i) &= \mathbf{E}(sr_i|HO_i = 1) \cdot Prob(HO_i = 1) + \mathbf{E}(sr_i|HO_i = 0) \cdot Prob(HO_i = 0) \\ &= \delta_0 HAF_i + \delta_1 \cdot d_2002sy_i + \delta_2 HAF_i \times d_2002sy_i + X_i \cdot \beta + \theta \cdot \Phi(\cdot); \end{aligned}$$

which justifies the two-stage estimation method of substituting $\Phi(\cdot)$ for HO_i . Note, this does not create a perfect multicollinearity problem of this model, because we substitute for HO a nonlinear function $\Phi(\cdot)$, not a linear function ($W_i \cdot \alpha + \delta'_0 HAF_i + \delta'_1 \cdot d_2002sy_i + \delta'_2 HAF_i \times d_2002sy_i + X_i \cdot \gamma$) as in usual simultaneous-equation models.

2.4.2 Results

The results of the two-step estimation procedure, in which the HAF contribution dummy and the income variable are considered, are reported in Table 2.6. The first step probit model only reports the coefficient of each variable but not the marginal effect. To do one step more, we can obtain the average marginal effects of these variables on the home ownership, and report them in the last column. For the same variable, the sign and significant level of the probit coefficient and the probit marginal effect are exactly the same. Furthermore, in order to correctly interpret the marginal effect of the interaction term between the HAF dummy and the 2002 year dummy on the home ownership, we adopt the method introduced by Ai and Norton (2003) and Norton, Wang and Ai (2004). Besides the results of the two-step estimation procedure,

Table 2.6: Estimation: Two-Step Estimation Results: HAF Dummy and Income

Estimation	(1)	(2)	(2)	(2)
Step	Direct	2nd step	1st step	1st step
Method	OLS	OLS	Probit Coefficient	Probit Marginal Effects
VARIABLES	Saving rate (sr)	Saving rate (sr)	Home ownership (HO)	Home ownership (HO)
APRH/1000			-0.737*** (0.170)	-0.293*** (0.0674)
$APRH^2/10^6$			0.184*** (0.0359)	0.0732*** (0.0143)
Dummy of HAF	-0.00266 (0.00765)	-0.0189* (0.00991)	-0.132*** (0.0402)	-0.0522*** (0.0159)
Dummy of survey year 2002	0.0109 (0.00864)	0.0226** (0.0106)	0.159*** (0.0542)	0.0630*** (0.0214)
Dummy of HAF×survey year 2002	-0.00107 (0.0111)	0.0828*** (0.0248)	0.665*** (0.0580)	0.255*** (0.0209)
Home ownership	0.00866 (0.00556)	-0.329*** (0.0853)		
Log income	0.178*** (0.00644)	0.199*** (0.00934)	0.176*** (0.0338)	0.0701*** (0.0134)
Age	-0.0119*** (0.00311)	-0.00900** (0.00374)	0.0263 (0.0163)	0.0104 (0.00646)
Squared age	0.000132*** (0.0000357)	0.000109** (4.25e-05)	-0.000215 (0.000187)	-0.0000854 (0.0000743)
Household size	-0.0135*** (0.00460)	-0.00979* (0.00551)	0.0293 (0.0240)	0.0116 (0.00955)
Dummy of any children	-0.0471*** (0.0100)	-0.0541*** (0.0120)	-0.0664 (0.0535)	-0.0263 (0.0211)
Education Level	-0.0115*** (0.00225)	-0.0109*** (0.00266)	0.00598 (0.0119)	0.00237 (0.00473)
Dummy of enterprises	-0.00210 (0.00484)	0.000233 (0.0100)	0.0215 (0.0447)	0.00852 (0.0177)
Dummy of permanent employee	0.0169** (0.00666)	0.0267*** (0.00823)	0.0870** (0.0349)	0.0345** (0.0139)
Working years in current unit	0.000193 (0.000342)	0.000281 (0.000404)	0.000845 (0.00180)	0.000335 (0.000714)
Dummy of Beijing	-0.0977*** (0.0130)	-0.146*** (0.0197)	-0.937*** (0.312)	-0.344*** (0.0941)
Dummy of Shanxi	0.0805*** (0.0124)	0.0749*** (0.0147)	-0.159** (0.0808)	-0.0633** (0.0322)
Dummy of Liaoning	-0.0185 (0.0115)	-0.0471*** (0.0154)	-0.208*** (0.0645)	-0.0827*** (0.0256)
Dummy of Anhui	0.0275** (0.0129)	0.0695*** (0.0185)	0.212** (0.0851)	0.0829** (0.0326)
Dummy of Henan	0.0661*** (0.0124)	0.101*** (0.0171)	0.0535 (0.101)	0.0212 (0.0401)
Dummy of Hubei	-0.0122 (0.0117)	0.0497** (0.0208)	0.453*** (0.0653)	0.173*** (0.0233)
Dummy of Guangdong	-0.0983*** (0.0123)	-0.0805*** (0.0152)	0.0956 (0.169)	0.0378 (0.0663)
Dummy of Sichuan and Chongqing	-0.0553*** (0.0112)	0.00498 (0.0201)	0.388*** (0.0716)	0.150*** (0.0263)
Dummy of Yunnan	0.0191 (0.0118)	0.122*** (0.0294)	0.866*** (0.0631)	0.306*** (0.0180)
Dummy of Gansu	0.0344** (0.0140)	0.0754*** (0.0195)	0.255*** (0.0815)	0.0995*** (0.0309)
Dummy of Economic Sector	✓	✓	✓	✓
lambda		0.207*** (0.0520)		
Constant	-1.151*** (0.0911)	-1.342*** (0.118)	-2.354*** (0.501)	
Observations	9,358	9,358	9,358	9,358

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

we also report the OLS estimation results ignoring the endogeneity problem induced by the home ownership and the instrumental effects in the first column.

We now discuss the results of the second step regression. The HAF contribution dummy after the 1999 reform has a positive and significant coefficient of 0.0865, which is summing up the coefficient of the HAF dummy, the 2002 year dummy and the interaction dummy between these two. It indicates that after the 1999 reform the households with any HAF contributors save 8.65 percent more than that without

any contributors. Although the home purchase is a qualified propose to get the HAF subsidized loans, of which the size is not large enough to purchase houses. In addition, a down payment of at least 20 percent of total house values is required and leads the households to save more. The coefficient of age is negative and significant, and that of squared age is positive and significant. However, these findings cannot confirm that the U-shape age-saving patten is induced by the 1999 reform. We will discuss this issue later. We also find that the coefficient of the home ownership is negative and significant, which indicates home owners save significantly less than the households without any houses. This result seems to be apparently inconsistent with findings of Chamon and Prasad (2010) and Brugiavini, Weber, and Wu (2010). However, the differences are mainly due to the fact that those two studies failed to consider the endogeneity problem induced by the home ownership. Intuitively, home owners do not need to save more for the down payment. Moreover, home owners are more likely to enter the credit market, since their houses can be used as the collateral if they have finished repaying the housing loans. Ignoring the endogeneity problem induced by the home ownership may result in a selection bias. In the second step regression, the highly significant coefficient of λ implies the endogeneity problem induced by the home ownership does exist and the two-step estimation resolves it.

If we compare the coefficients of the relevant variables in the first two columns, we find that the coefficients of the HAF dummy, the 2002 year dummy, and the interaction dummy between these two are not significant in OLS. Moreover, if the endogeneity problem is ignored, the home ownership dummy has a positive and insignificant coefficient.

We move to discuss the first step probit marginal effects in the last column. The average prices of residential house divided by 1000 (APRH/1000) has a negative and highly significant marginal effect of -0.293 on the home ownership. It implies that increasing 1000 Yuan (equivalently 353.37 US dollar in 2011) in the average prices

of residential house, the probability of having a house decreases 29.3 percent. The HAF contribution effect after reform on home ownership is positive, since the sum of the HAF contribution dummy, the 2002 year dummy and the interaction dummy between these two is 0.300. It indicates that after the 1999 HAF policy intervention, the households with any HAF contributors are more likely to be home owners. It somewhat reflects that HAF programme performs well. Not only establishes a compulsory saving for the households, but also, as partial package of housing finance reconstruction, HAF motivates the households' home purchase performance by providing the subsidized HAF mortgage loans. The log of income has a positive and significant marginal effect of 0.0701, and the demographic variables and the household composition variables are not significant. Intuitively, the households with higher income have larger budget in the home purchase activity. The household's budget level is more relevant than the demographic and the household composition. For the household head's employment characteristics, only the permanent employment dummy has the positive and significant effect on the home ownership. Even after the 1999 HAF policy intervention, temporary employees and short-term employees are still not allowed to contribute to HAF and therefore to use the fund for housing providers.

Another important issue that need to be taken into account is the validity of the instrumental variables. In principle, the perfect instrumental variable would be regulatory prices. However, the average prices of residential house and its square are not, because they represent the market equilibrium prices, which are determined by the interaction between the demand-side and the supply-side. Before providing the two-step estimations, we can only assume that $APRH$ and $APRH^2$ are valid. The significant marginal effects of $APRH$ and $APRH^2$ on the home ownership confirm that they do affect the home ownership. In addition, we need to examine the tested χ^2 value of these two instrumental variables after the first step probit estimation. The tested χ^2 value is 27.09, which is large enough. Next, we need to consider whether the

Table 2.7: Validity Test of Instrumental Variables

Residuals of the second step	Table 2.6	Table 2.8	Table 2.9
APRH/1000	0.0199 (0.0179)	0.0210 (0.0185)	0.0130 (0.0186)
$APRH^2/10^6$	-0.00474 (0.00400)	-0.00478 (0.00414)	-0.00321 (0.00416)
Constant	-0.0163 (0.0161)	-0.0178 (0.0167)	-0.0103 (0.0168)
Observations	9,358	9,358	9,358
R-squared	0.0002	0.0001	0.0001

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: Each column corresponds to the validity test of the instrumental variables of the second step. The dependent variable of each OLS estimation is the residuals of the second step OLS estimation reported in each Table.

instrumental variables affect the saving rate or not. It is relevant to consider an OLS estimation, where the dependent variable is the residuals obtained after the second step regression and the independent variables are the average price of residential house and its square. The results are given in the first column of Table 2.7. The insignificant coefficients of the average price of residential house and its square imply that they are uncorrelated with the residuals in the second step regression, thus they do not affect the saving rate. The previous arguments indicate that APRH and $APRH^2$ are valid.

In Table 2.8 we report the results of two-step estimation procedure, which does not consider the log of income. The results are consistent with those reported in Table 2.6. The coefficient of the HAF contribution dummy after the reform is positive and significant, and the overall HAF contribution effect on the saving rate after 1999 reform becomes 0.186, which is much higher than controlling the log of income. Moreover, the positive and significant coefficient of the education level is completely different from the corresponding coefficient reported in Table 2.6. It reconciles with the findings in most studies that the education variable is a proxy of the household's welfare distribution, thus it correlates with the income. The home ownership effect on the saving rate is negative and significant. The significant coefficient of λ implies that OLS does induce a selection bias. If we compare the results of OLS and the

Table 2.8: Estimation: Two-Step Estimation Results: HAF Dummy

Estimation	(1)	(2)	(2)	(2)
Step	Direct	2nd step	1st step	1st step
Method	OLS	OLS	Probit Coefficient	Probit Marginal Effects
VARIABLES	Saving rate (sr)	Saving rate (sr)	Home ownership (HO)	Home ownership (HO)
APRH/1000			-0.708*** (0.169)	-0.281*** (0.0673)
$APRH^2/10^6$			0.187*** (0.0359)	0.0741*** (0.0142)
Dummy of HAF	0.0265*** (0.00788)	0.0136 (0.00982)	-0.101** (0.0397)	-0.0401** (0.0157)
Dummy of survey year 2002	0.0493*** (0.00887)	0.0659*** (0.0112)	0.189*** (0.0539)	0.0750*** (0.0213)
Dummy of HAF×survey year	0.0310*** (0.0115)	0.120*** (0.0267)	0.695*** (0.0577)	0.265*** (0.0206)
Home ownership	0.0171*** (0.00577)	-0.325*** (0.0889)		
Age	-0.0103*** (0.00323)	-0.00708* (0.00387)	0.0279* (0.0162)	0.0111* (0.00645)
Squared age	0.000128*** (3.71e-05)	0.000105** (4.39e-05)	-0.000218 (0.000187)	-8.66e-05 (7.42e-05)
Household size	0.00622 (0.00473)	0.0124** (0.00577)	0.0492** (0.0237)	0.0195** (0.00943)
Dummy of any children	-0.0590*** (0.0105)	-0.0677*** (0.0125)	-0.0788 (0.0534)	-0.0312 (0.0210)
Education level	0.00404* (0.00227)	0.00649** (0.00273)	0.0217* (0.0115)	0.00862* (0.00457)
Dummy of enterprises	-0.00875 (0.00882)	-0.00721 (0.0103)	0.0156 (0.0446)	0.00620 (0.0177)
Dummy of permanent employee	0.0213*** (0.00692)	0.0319*** (0.00855)	0.0916*** (0.0349)	0.0365*** (0.0139)
Working years in current unit	0.000514 (0.000356)	0.000643 (0.000418)	0.00122 (0.00179)	0.000486 (0.000713)
Dummy of Beijing	-0.0453*** (0.0134)	-0.0883*** (0.0192)	-0.978*** (0.312)	-0.357*** (0.0913)
Dummy of Shanxi	0.0226* (0.0127)	0.00981 (0.0152)	-0.202** (0.0804)	-0.0805** (0.0319)
Dummy of Liaoning	-0.0446*** (0.0119)	-0.0768*** (0.0163)	-0.241*** (0.0642)	-0.0958*** (0.0254)
Dummy of Anhui	-0.0158 (0.0133)	0.0216 (0.0183)	0.185** (0.0849)	0.0728** (0.0328)
Dummy of Henan	0.0114 (0.0127)	0.0404** (0.0167)	0.0210 (0.101)	0.00834 (0.0401)
Dummy of Hubei	-0.0422*** (0.0121)	0.0169 (0.0209)	0.433*** (0.0651)	0.166*** (0.0235)
Dummy of Guangdong	-0.0258** (0.0125)	0.00120 (0.0162)	0.116 (0.169)	0.0460 (0.0660)
Dummy of Sichuan and Chongqing	-0.0875*** (0.0116)	-0.0302 (0.0201)	0.369*** (0.0714)	0.143*** (0.0265)
Dummy of Yunnan	-0.0156 (0.0122)	0.0844*** (0.0296)	0.832*** (0.0627)	0.296*** (0.0183)
Dummy of Gansu	-0.0354** (0.0143)	-0.00230 (0.0188)	0.197** (0.0806)	0.0773** (0.0310)
Dummy of Economic Sector lambda	✓	✓	✓	✓
Constant	0.371*** (0.0753)	0.365*** (0.0883)	-0.882** (0.414)	
Observations	9,358	9,358	9,358	9,358
R-squared	0.057			

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

second step regression, we find that the magnitude of HAF contribution effect after the 1999 reform is small in the OLS estimation.

For what concerns the analysis of the determinant of the home ownership, the marginal effect of the HAF contribution after reform is 0.299, which is the same as that without including the log of income. However, without controlling the log of income, the marginal effects of age and household size become significant, and the signs are unchanged. Finally, we also examine the validity of the instrumental variables. The significant marginal coefficients of $APRH$ and $APRH^2$ and the tested χ^2 value 27.35 jointly indicate that $APRH$ and $APRH^2$ are valid for the first step probit estimation. For the second step estimation, the coefficients reported in the second column of Table 2.7 indicate $APRH$ and $APRH^2$ are valid for the second step estimation if log of income is out of control.

The previous estimation results only identify differences in the saving rate and the home ownership between the households with any HAF contributors and those without any contributors. Intuitively, the households with higher accumulated amount of HAF can obtain a larger size of the subsidized HAF mortgage. Moreover, the households with higher accumulated amount of HAF are more likely to benefit from it, whereas those with lower amount of HAF savings are reluctant to get sizable HAF loans, especially for low income households (Chen 2009). We observe from Table 3.1 that the average accumulated amount of HAF has increased substantially from 1995 to 2002. It is relevant to explore the households' saving behavior and the home ownership situation by considering the households with different accumulated amount of HAF. We would like to replicate two-step estimation procedure, considering no more the HAF dummy but the accumulated amount of HAF. Moreover, we replace the interaction dummy between the HAF dummy and the 2002 year dummy with the interaction between the accumulated amount of HAF and the 2002 year dummy. We do control for the same set of control variables. In order to understand and explain the

Table 2.9: Two-Step Estimation Results: Accumulated Amount of HAF

Estimation	(1)	(2)	(2)	(2)
Step		2nd step	1st step	1st step
Method	OLS	OLS	Probit Coefficient	Probit Marginal Effects
VARIABLES	Saving rate (sr)	Saving rate (sr)	Home ownership (HO)	Home ownership (HO)
APRH/1000			-0.901*** (0.169)	-0.358*** (0.0671)
$APRH^2/10^6$			0.210*** (0.0360)	0.0836*** (0.0143)
AAHAF/1000	-0.00797 (0.0129)	-0.0302* (0.0165)	-0.170** (0.0818)	-0.0675** (0.0325)
Dummy of survey year 2002	0.00829 (0.00675)	0.0656*** (0.0152)	0.481*** (0.0462)	0.189*** (0.0178)
AAHAF/1000×survey year	0.00809 (0.0129)	0.0328** (0.0167)	0.187** (0.0816)	0.0742** (0.0324)
Home ownership	0.00828 (0.00552)	-0.371*** (0.0846)		
log income	0.177*** (0.00636)	0.210*** (0.0107)	0.239*** (0.0333)	0.0952*** (0.0132)
Age	-0.0119*** (0.00311)	-0.00824** (0.00389)	0.0289* (0.0162)	0.0115* (0.00645)
Squared age	0.000132*** (3.57e-05)	9.95e-05** (4.43e-05)	-0.000263 (0.000186)	-0.000104 (7.41e-05)
Household size	-0.0133*** (0.00460)	-0.0108* (0.00566)	0.0152 (0.0239)	0.00606 (0.00948)
Dummy of any children	-0.0473*** (0.0101)	-0.0547*** (0.0125)	-0.0580 (0.0531)	-0.0230 (0.0210)
Education level	-0.0115*** (0.00225)	-0.0104*** (0.00277)	0.00968 (0.0119)	0.00385 (0.00471)
Dummy of enterprises	-0.00218 (0.00848)	0.00323 (0.0105)	0.0401 (0.0444)	0.0160 (0.0176)
Dummy of permanent employees	0.0165** (0.00662)	0.0335*** (0.00895)	0.125*** (0.0346)	0.0498*** (0.0138)
Working years in current unit	0.000174 (0.000341)	0.000531 (0.000425)	0.00273 (0.00178)	0.00109 (0.000708)
Dummy of Beijing	-0.0975*** (0.0130)	-0.151*** (0.0199)	-0.862*** (0.313)	-0.321*** (0.0984)
Dummy of Shanxi	0.0806*** (0.0123)	0.0777*** (0.0151)	-0.178** (0.0804)	-0.0710** (0.0320)
Dummy of Liaoning	-0.0183 (0.0115)	-0.0466*** (0.0154)	-0.160** (0.0640)	-0.0638** (0.0255)
Dummy of Anhui	0.0274** (0.0129)	0.0778*** (0.0193)	0.182** (0.0846)	0.0715** (0.0327)
Dummy of Henan	0.0665*** (0.0123)	0.107*** (0.0176)	-0.00936 (0.100)	-0.00372 (0.0398)
Dummy of Hubei	-0.0120 (0.0117)	0.0633*** (0.0220)	0.464*** (0.0650)	0.177*** (0.0232)
Dummy of Guangdong	-0.0979*** (0.0122)	-0.0787*** (0.0156)	0.164 (0.168)	0.0644 (0.0654)
Dummy of Sichuan and Chongqing	-0.0554*** (0.0111)	0.0188 (0.0214)	0.394*** (0.0712)	0.152*** (0.0262)
Dummy of Yunnan	0.0191 (0.0118)	0.141*** (0.0307)	0.893*** (0.0627)	0.314*** (0.0177)
Dummy of Gansu	0.0345** (0.0140)	0.0886*** (0.0209)	0.273*** (0.0813)	0.106*** (0.0307)
Dummy of Economic Sector	✓	✓	✓	✓
lambda		0.233*** (0.0517)		
Constant	-1.144*** (0.0902)	-1.470*** (0.132)	-2.951*** (0.498)	
Observations	9,358	9,358	9,358	9,358
R-squared	0.128			

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

results easily, we divide the accumulated amount of HAF by 1000 (AAHAF/1000). The estimation results are reported in Table 2.9.

We now discuss the results of the second step regression in Table 2.9. The accumulated amount of HAF over 1000 after reform has a positive and significant coefficient of 0.0682. It indicates after the 1999 reform, the households, which have an additional accumulated 1000 Yuan in the HAF account, on average save 6.82 percent more. One

possible option for the households with the larger accumulated amount of HAF is to purchase the higher quality houses, which are associated with a higher amount of the down payment. It promotes such households to save more. Another possibility is such households could obtain a larger size of the HAF subsidized loans, thus the amount of repayment is relatively smaller. Borrowers are sensitive to the increase in the mortgage rate (Deng, Shen, and Wang 2009), they may pay back their loans ahead of the term in order to avoid the increment of the rate (Yang and Shen 2008). The significant coefficient of λ implies that the direct OLS induces a selection bias in this specification.

Let us discuss the estimation results of the probit marginal effects in the last column of Table 2.9. We can still observe that $APRH/1000$ has a negative and highly significant marginal effect on the home ownership. The accumulated amount of HAF over 1000 after the 1999 reform has a positive and significant coefficient on home ownership of 0.196. It indicates that, after 1999 HAF became compulsory, the households with the higher accumulated savings in their HAF accounts are more likely to be the home owners. Having 1000 Yuan (equivalently 353.37 US dollar in 2011) more deposited in the HAF account, the average probability of having houses increases 19.6 percent. It coincides with partial findings of Chen (2009), where households with higher accumulated HAF savings are more likely to benefit from HAF. When controlling the log of income, the demographic variables and the household composition variables are not significant. For the household heads' employment characteristics, only the permanent employment dummy has the positive and significant effect on the home ownership, which is same as the results reported in Table 2.6. The significant marginal coefficients of the average price of the residential house and its square and the tested χ^2 value 36.51 jointly indicate $APRH$ and $APRH^2$ are valid for the first step probit estimation. For the second step estimation, the coefficients in third

column of Table 2.7 indicate that APRH and $APRH^2$ are valid for the second step estimation.

To conclude this section, we would like to investigate the reasons of the U-shape patterns of the household's age-saving profile. We construct three age group dummies. The first age group dummy represents young households and takes value 1 if their heads are aged between 25 and 35, and 0 otherwise; the second age group dummy represents middle-age households and takes value 1 if their heads are aged between 36 and 50, and 0 otherwise; and the third age group dummy represents old households and takes value 1 if their heads are aged between 51 and 65, and 0 otherwise. Moreover, we also construct the interaction dummy between each age group dummy and the HAF contribution dummy, as well as the interaction dummy among each age group dummy, the HAF contribution dummy and the 2002 year dummy. We do control for the same set of control variables. Table 2.10 reports the estimation results, and the third age group dummy is the reference point.

If the log of income is controlled in the estimation, we find that, with respect to the old households (the heads aged between 51-65), the young households (the heads aged between 25-35) save 6.92 percent less after the 1999 reform, and the middle-age households (the heads aged between 36-50) save 8.27 percent less after the 1999 reform. If the log of income is not controlled, the young households save 5.37 percent less after the 1999 reform, and the middle-age households save 10.09 percent less after the 1999 reform. Intuitively, regardless of considering the log of income, the young households save more than the middle-age households. These findings can partially explain the U-shape age-saving profile. The young households entered in the job market only few years and have less accumulated years of contributions to HAF and therefore, have less accumulated amount of wealth. If young households decide to purchase the houses, although the HAF contributors could apply for the HAF subsidized mortgage loans, they still need to save for the down payment, which

Table 2.10: Two-step Estimation Result: Take into Account the Age Group Dummy

VARIABLES	(1)	(1)	(2)	(2)
	Saving Rate OLS	Home ownership Probit coefficient	Saving Rate OLS	Home ownership Probit coefficient
APRH/1000		-0.720*** (0.170)		-0.693*** (0.170)
$APRH^2/10^6$		0.177*** (0.0360)		0.180*** (0.0360)
Dummy of HAF	-0.0363* (0.0211)	-0.238*** (0.0866)	-0.00184 (0.0213)	-0.205** (0.0862)
Dummy of 2002 survey year	0.0245** (0.0108)	0.173*** (0.0542)	0.0687*** (0.0115)	0.206*** (0.0538)
Dummy of HAF \times 2002 survey year	0.129*** (0.0352)	0.864*** (0.102)	0.166*** (0.0373)	0.895*** (0.102)
Dummy of age group1 ($25 \leq age \leq 35$)	0.0141 (0.0159)	-0.0635 (0.0680)	-0.0219 (0.0165)	-0.0962 (0.0678)
Dummy of age group2 ($36 \leq age \leq 50$)	-0.0279** (0.0134)	-0.0864 (0.0565)	-0.0417*** (0.0139)	-0.0994* (0.0564)
Dummy of age group1 \times HAF	-0.0120 (0.0254)	-0.0346 (0.112)	-0.0144 (0.0261)	-0.0368 (0.112)
Dummy of age group2 \times HAF	0.0324 (0.0225)	0.194** (0.0953)	0.0307 (0.0231)	0.193** (0.0951)
Dummy of age group1 \times HAF \times 2002 survey year	-0.0692** (0.0296)	-0.299** (0.128)	-0.0537* (0.0304)	-0.284** (0.127)
Dummy of age group2 \times HAF \times 2002 survey year	-0.0548** (0.0241)	-0.252** (0.104)	-0.0592** (0.0248)	-0.256** (0.104)
Log income	0.201*** (0.00953)	0.184*** (0.0338)		
Home ownership			-0.331*** (0.0889)	
Household size	-0.00847 (0.00558)	0.0365 (0.0240)	0.0143** (0.00586)	0.0576** (0.0237)
Dummy of any children	-0.0579*** (0.0119)	-0.0832 (0.0522)	-0.0740*** (0.0124)	-0.0983* (0.0521)
Education level	-0.0105*** (0.00268)	0.00681 (0.0119)	0.00679** (0.00276)	0.0230** (0.0115)
Dummy of enterprises	0.000250 (0.0101)	0.0195 (0.0447)	-0.00795 (0.0104)	0.0128 (0.0447)
Dummy of permanent employment	0.0262*** (0.00827)	0.0837** (0.0350)	0.0314*** (0.00856)	0.0884** (0.0349)
Working year in current unit	0.000307 (0.000398)	0.00177 (0.00175)	0.000837** (0.000412)	0.00233 (0.00174)
Province dummy	✓	✓	✓	✓
Dummy of economic sector	✓	✓	✓	✓
lambda	0.213*** (0.0522)		0.213*** (0.0542)	
Constant	-1.522*** (0.0847)	-1.682*** (0.391)	0.287*** (0.0478)	-0.0643 (0.254)
Observations	9,358	9,358	9,358	9,358

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

is compulsory to all the mortgage borrowers. Once the loan application is approved, the bought houses are considered as collateral, and the young households move to the repayment term. The typical mortgage loans are completely repaid after about 10 to 15 years (Zhu 2006). It implies, different from the young households, the middle-age households have finished or almost finished repaying loans. They do not need to save as many as the young households.

Finally, we consider some additional specifications of the model. Since the households with the larger accumulated amount of HAF can apply for the larger size of the HAF subsidized mortgage loans, we want to consider a leverage proxy combining both the accumulated amount of HAF and the house values. The leverage proxy is

Table 2.11: Descriptive Statistics of Additional Variables

Variable	1995		2002	
	Yuan	US dollar in 2012	Yuan	US dollar in 2012
Leverage ratio	0.0599(4.03)		0.101(2.44)	
Fixed deposit	7329.71(11737.31)	2580.25	16256.19(26534.55)	5722.61
Current account	1280.64(2608.803)	450.82	4893.51(9858.06)	1722.64
Stock	400.77(2214.06)	141.08	3792.12(14774.97)	1334.93
Bond	970.03(2992.17)	341.49	1089.16(7739.95)	383.41
Credit	350.03(1659.96)	123.22	1393.79(8445.78)	490.65
Value of durable good	8244.49(8585.92)	2902.28	8894.00(28582.14)	3130.92
Value of other asset	1698.79(5594.55)	592.02	1858.02(8123.40)	654.07
Debt	869.11(6645.81)	869.11	5738.64(58360.41)	2002.15

Note: All the economic variables are in real terms. That in 1995 are the baseline, and that in 2002 are CPI adjusted by 100/110.6. Stock is the value that household invest in two Chinese stock market in Shanghai and Shenzhen. Bond indicates the households' investing in national bonds and corporate bonds. Credit is the total money that households lend out. Household debt contains the debt on durable good, debt on medical care, debt on house, and debt for business operation. Household debt indicates household borrow money either from banks or from their relatives and friends. The US dollar equivalent in 2011 of each variable is computed as follows: first convert the value to 2012 term according to CPI, and second adjusted by Purchasing Power Parity (PPP) between Yuan and US dollar in 2011. The source of PPP between Yuan and US dollar is published by IMF. The difference of each variable between 1995 and 2002 is statistically significant at 5 percent level.

defined as the ratio between the accumulated amount of HAF and houses values.¹⁹ The higher value of the leverage ratio means that the households have a relatively larger accumulated amount of HAF or the lower house values, or both. Moreover, after the Chinese financial market reform, more financial products are available to urban households. We want to understand the impact of the households' portfolio choices on their saving decisions. We will provide two groups of specifications, one which controls the leverage ratio, the other which takes into account the household's portfolio composition. The descriptive statistics of these relevant variables is given in Table 2.11, and the estimation results are reported in Table 2.12 and 2.13.

From Table 2.12 we can observe that when the leverage ratio is controlled, after the 1999 reform, the HAF contribution effect on the saving rate is positive and significant, where the marginal effect is 0.0866 if the log of income is controlled and it is 0.186 if the log of income is not controlled. In addition, the households with additional 1000 Yuan saving in the accumulated account save 6.83 percent more compared with those without any HAF contributors. In all these three specifications, we find that the home ownership has the negative and significant effect on the saving rate. The coefficients of the leverage ratio are negative and insignificant in all these specifications. From Table 2.13 we can infer that even if the households' portfolio choices are controlled, after the 1999 reform, the HAF contribution effect on the saving rate is positive and

¹⁹If the households do not have any private houses, the ratio is defined as zero.

Table 2.12: Two-Step Estimation Results: Take into Account Leverage parameter

VARIABLES Estimation	(1) Saving Rate OLS	(1) Home ownership Probit Coefficient	(2) Saving Rate OLS	(2) Home ownership Probit Coefficient	(3) Saving Rate OLS	(3) Home ownership Probit Coefficient
APRH/1000		-0.737*** (0.170)		-0.708*** (0.169)		-0.901*** (0.169)
APRH/10 ⁶		0.184*** (0.0359)		0.187*** (0.0359)		0.210*** (0.0360)
HAF dummy	-0.0188* (0.00991)	-0.132*** (0.0402)	0.0137 (0.00982)	-0.101** (0.0397)		
Dummy of 2002 year	0.0226** (0.0106)	0.159*** (0.0542)	0.0659*** (0.0112)	0.189*** (0.0539)	0.0656*** (0.0152)	0.481*** (0.0462)
Dummy of HAF×2002 year	0.0828*** (0.0248)	0.665*** (0.0580)	0.120*** (0.0267)	0.695*** (0.0577)		
AAHAF/1000						
AAHAF/1000×2002 year						
Home ownership	-0.329*** (0.0853)	0.176*** (0.0338)	-0.325*** (0.0889)		-0.0301* (0.0165)	-0.170** (0.0818)
Log income	0.199*** (0.00934)	0.00981* (0.000525)			0.0328** (0.0167)	0.187** (0.0816)
Leverage ratio	-0.000525 (0.000886)	0.000148 (0.00470)	-0.000454 (0.000915)	0.000213 (0.00464)	0.0107 (0.000920)	0.239*** (0.0333)
Age	-0.00902** (0.00374)	0.0263 (0.0163)	-0.00710* (0.00387)	0.0279* (0.0162)	-0.00826** (0.00389)	0.000196 (0.00461)
Squared age	0.000109** (4.25e-05)	-0.000215 (0.000187)	0.000105** (4.39e-05)	-0.000218 (0.000187)	9.98e-05** (4.43e-05)	-0.000263 (0.000187)
Household size	-0.00981* (0.00551)	0.0293 (0.0240)	0.0124** (0.00577)	0.0492** (0.0237)	-0.0108* (0.00566)	0.0152 (0.0239)
Dummy of any children	-0.0541*** (0.0120)	-0.0664 (0.0535)	-0.0676*** (0.0125)	-0.0788 (0.0534)	-0.0547*** (0.0125)	-0.0580 (0.0531)
Education level	-0.0109*** (0.00266)	0.00598 (0.0119)	0.00650** (0.00273)	0.0217* (0.0115)	-0.0104*** (0.00277)	0.00968 (0.0119)
Dummy of enterprises	0.000243 (0.0100)	0.0215 (0.0447)	-0.00720 (0.0103)	0.0156 (0.0446)	0.00324 (0.0105)	0.0401 (0.0444)
Dummy of permanent employee	0.0267*** (0.00823)	0.0870** (0.0349)	0.0319*** (0.00855)	0.0916*** (0.0349)	0.0335*** (0.00895)	0.125*** (0.0346)
Working years in current unit	0.000281 (0.000404)	0.000845 (0.00180)	0.000643 (0.000418)	0.00122 (0.00179)	0.000531 (0.000425)	0.00273 (0.00178)
lambda		0.207*** (0.0520)		0.209*** (0.0542)		0.233*** (0.0517)
Province dummy	✓	✓	✓	✓	✓	✓
Dummy of economic sector	✓	✓	✓	✓	✓	✓
Constant	-1.342*** (0.118)	-2.354*** (0.501)	0.365*** (0.0883)	-0.882** (0.414)	-1.469*** (0.132)	-2.951*** (0.498)
Observations	9,358	9,358	9,358	9,358	9,358	9,358

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.13: Two-Step Estimation Results: Take into Account Portfolio Choice

VARIABLES Estimation	(1)		(2)		(3)	
	Saving Rate OLS	Home ownership Probit Coefficient	Saving Rate OLS	Home ownership Probit Coefficient	Saving Rate OLS	Home ownership Probit Coefficient
APRH/1000		-0.698*** (0.170)		-0.666*** (0.170)		-0.874*** (0.169)
$APRH^2/10^6$		0.168*** (0.0362)		0.166*** (0.0361)		0.198*** (0.0362)
Dummy of HAF		-0.130*** (0.00972)		-0.108*** (0.0398)		
Dummy of 2002 survey year	-0.0175* (0.0210**)	0.0101 (0.0546)	0.0121 (0.0112)	0.161*** (0.0543)	0.0604*** (0.0149)	0.472*** (0.0465)
Dummy of HAF×2002 survey year	0.0757*** (0.0248)	0.666*** (0.0582)	0.119*** (0.0272)	0.686*** (0.0579)		
AAHAF/1000						
AAHAF/1000×2002 survey year						
log income	0.199*** (0.00882)	0.135*** (0.0355)				
Home ownership	-0.306*** (0.0863)					
Age	-0.00956*** (0.00367)	0.0252 (0.0163)	-0.00741* (0.00393)	0.0263 (0.0163)	-0.0286* (0.0162)	-0.169** (0.0819)
Squared age	0.000114*** (4.17e-05)	-0.000205 (0.00187)	0.000107** (4.46e-05)	-0.000207 (0.00187)	0.0312* (0.0163)	0.184** (0.0818)
Fixed deposit/1000	0.000137 (0.000169)	0.00137* (0.000745)	0.000999*** (0.000184)	0.00193*** (0.000731)	0.209*** (0.0101)	0.207*** (0.0348)
Current account/1000	0.000373 (0.000468)	0.00429** (0.00217)	0.00178*** (0.000507)	0.00515** (0.00216)	-0.347*** (0.0847)	
Stock/1000	-3.22e-05 (0.000306)	0.00176 (0.00143)	0.000569* (0.000330)	0.00210 (0.00142)	-0.00887** (0.00381)	0.0276* (0.0163)
Bond/1000	0.000296 (0.000549)	0.00457* (0.00275)	0.00135** (0.000592)	0.00531* (0.00276)	0.000136 (0.000174)	0.00127* (0.000742)
Credit/1000	-0.000226 (0.000517)	0.00374 (0.00279)	0.000199 (0.000555)	0.00414 (0.00288)	0.000353 (0.000479)	0.00347 (0.00214)
Durable good/1000	-0.000465*** (0.000149)	-0.000444 (0.000671)	-0.000146 (0.000159)	-0.000234 (0.000644)	1.11e-05 (0.000319)	0.00199 (0.00142)
Other asset/1000	-0.000424 (0.000460)	0.00491** (0.00215)	0.000144 (0.000496)	0.00535** (0.00218)	0.000275 (0.000566)	0.00415 (0.00277)
Household debt/1000	-0.000102 (7.47e-05)	-0.000412 (0.000315)	-3.56e-05 (7.97e-05)	-0.000365 (0.000319)	-0.000266 (0.000531)	0.00303 (0.00276)
Household composition Employment characteristics	✓	✓	✓	✓	✓	✓
Province dummy	✓	✓	✓	✓	✓	✓
Dummy of economic sector	✓	✓	✓	✓	✓	✓
lambda	0.192*** (0.0526)		0.223*** (0.0564)			
Constant	-1.325*** (0.113)	-2.006*** (0.509)	0.377*** (0.0898)	-0.881** (0.415)	-1.444*** (0.126)	-2.667*** (0.505)
Observations	9,358	9,358	9,358	9,358	9,358	9,358

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

significant. If the log of income is controlled, the marginal effect of HAF contribution on the saving rate is 0.0792; while it is equal to 0.175 if the log of income is not controlled. The households with the higher accumulated amount of HAF save more. Still the home ownership has negative and highly significant effect on the saving rate. The results reported in Table 2.12 and 2.13 indicate that the HAF contribution effect and the accumulated amount of HAF effect on the saving rate are robust.

2.4.3 Policy Implications

For what concerns the determinants of the saving rate, our results suggest that the households with any HAF contributors and those with the larger accumulated amount of HAF save more. One potential reason is that the households save to prepare the down payment. Indeed, the lowest down payment, which is determined by PBoC, has to reach at least 20 percent of total house values. The other important issue promoting urban households to save is the limited size of the HAF subsidized loans. The households with any members contributing to HAF can apply for the HAF subsidized loan as much as 10 to 15 times of the accumulated amount of HAF, which may not be sufficient to purchase a house (Chen 2009). If the local HAF management department could enlarge the HAF subsidized loan size, urban households may reduce their savings. In order to enlarge the size of the HAF loans, the local HAF management department needs to have sufficient capital. However, most of HAF funds are investing in the Chinese treasury bonds, which is not a preferable manner (Deng, Shen and Wang 2009). The local HAF management department needs to look for other efficient and more preferable options for the HAF investment. They also suggested alternative investment option for HAF savings is to invest in Cheap Rent House (CRH) projects. The local HAF management department has to enlarge the amount of the investment in CRH. Finally, HAF is a kind of tax contribution and the households can withdraw all the money saved in HAF accounts only for the qualified housing purpose or after

the retirement. This implies that the contributing to HAF reduces urban households daily budget for other consumption purposes. Possibly, the households prefer to save more to protect their future uncertainty. It is necessary to expand the HAF usage to a broader scale. The Chinese government has already launched a pilot project expanding the usage of HAF, such as withdrawing HAF savings for serious disease, paying for the children's education fee, etc. Possibly these implementations would smooth urban household saving.

We find that the HAF contribution dummy has the positive effect on the home ownership, regardless of the income level. These findings imply that the households with any HAF contributors are more likely to have private houses. As we have introduced, the main purpose of HAF is to support the privatization of public housing stocks in the housing reform, as well as to motivate the development of the demand side of the housing market, via providing subsidized housing mortgage to its contributors. The HAF implementation is successful, and has attained the main objective. However, temporary employees and short-term contract employees are still not included in the programme after the 1999 reform. We suggest an extension of the border of HAF collection, in which all urban employees are included. Possibly, the temporary and short-term employees cannot have enough money to purchase houses. The Chinese government should enhance the CRH project, and provide CRH to them. In addition, we find that the households with the larger accumulated amount of HAF are more likely to have private houses. On the contrary, the households with lower accumulated amount of HAF are less likely to be the home owners because they are reluctant to get the sizable loans (Chen 2009). Fortunately, the Chinese government has already launched Economical Residential House (ERH) projects after 1999, in which developers' maximal profit rate cannot exceed 3 percent. Products of ERH have to be provided to the households with lower accumulated amount of HAF. In practice, most developers are not willing to join in the ERH project owing to the

low profit. As a consequence, there do not exist sufficient ERH housing stocks to the households with low accumulated amount of HAF savings. The Chinese government has to enhance the ERH project and to provide sufficient housing stocks to such households.

2.5 Conclusion

According to our knowledge, there is no study that concentrates on the effect of the Chinese housing finance reform occurred between 1994 to 1999 on the urban households' economic behavior. This paper focuses on the housing finance reform, especially on the effect of the Housing Accumulation Fund (HAF) on the household saving rate and the home ownership.

Using two waves of the Chinese Household Income Project Survey data set for urban Chinese household in 1995 and 2002, we adopt a two-step estimation procedure to test the relation between HAF and the household saving rate, as well as the relation between HAF and the home ownership. Our estimation results show that the HAF contribution positively affects the saving rate. To be precise, the households with the larger accumulated amount of HAF save more. Although the households contributing to HAF could apply for the subsidized housing mortgage loans, the amount of loans may not be sufficient to purchase a house. Joint with the down payment regulation determined by the People's Bank of China, Chinese urban households have to save more in order to purchase houses. These findings confirm that HAF works as a way to motivate the accumulation of financial sources to be used as a down payment. In addition, we explore the saving behavior of young households (the heads aged between 25-35) and middle-age households (the heads aged between 36-50) if they have any HAF contributors. We find that, after the 1999 reform, the young households save more than the middle-age households and both groups of households save less than the

old households (the heads aged between 51-65), which partially explain the U-shape age-saving profile. The young households have few accumulated wealth and under the pressure of the down payment, thus save more. Since the middle-age households may have finished repaying the mortgage loans, they do not have to save as many as the households younger than them. The two-step estimation procedure solves the endogeneity problem induced by the home ownership, and our empirical results imply that households with private houses save less. This result is not consistent with previous findings, which failed to consider the endogeneity problem.

For what concerns the determinants of the home ownership, our results suggest that the households with any HAF contributors are more likely to be home owners. It implies that the HAF implementation is successful. We suggest that HAF should include all urban employees, such that temporary and short-term employees can benefit from this program. To be precise, the households with the larger accumulated amount of HAF are more likely to have private houses. We suggest that the Chinese government should enhance the Economical Residential House project, so that households with lower accumulated amount of HAF can also benefit from the program.

We find that, as a partial package of the housing finance reform, HAF constitutes an additional element explaining the determinants of Chinese households' saving rate. However, to have a broader understanding of the households' saving decisions, other reforms such as those in the pension system and in the health care system should also be taken into account.

Chapter 3

Health Care Sector Reform and Household Saving Decisions in Urban China

3.1 Introduction

The Chinese health care system, which is an important component of the social security system, was founded in the 1950s. Before 1978, urban Chinese State-owned enterprises (SOEs), government agencies, and public institutions had the responsibility to provide, either free or at low prices, a wide range of social services to their current and retired employees and often their dependents. The cash wage was just a component of the package with a wide range of in kind benefits, such as health care services. There were two important components of the urban Chinese health care system: the Labor Insurance Scheme (LIS) and the Government Insurance Scheme (GIS). LIS was an enterprises-based insurance scheme, which born all the cost of medical treatments, medicines and hospitalizations of the SOEs employees and their dependents. GIS was the public health care system and mainly served the employees

of the governments and institutions. Under GIS, the employees' medical bills could be covered by the government budgetary allocation. Before the end of the 1970s, almost all medical costs of the LIS and BIS beneficiaries could be reimbursed and both schemes have performed well.

China has started its economic reform in 1978. The economic reform brought about the market competition and some of SOEs that were not able to make any profits were forced to default on their social obligations such as paying the employees' medical bills. Consequently, the employees who were covered by LIS and worked in such SOEs lose their basic health care services. However, the employees covered by GIS could still access the free medical health care services after 1978. There existed an inequity in the health care expenses between the employees working in SOEs and those working in the governments and institutions. Meanwhile, the costs of the medical treatments, the medicines, and the hospitalizations have increased remarkably. Between 1989 and 1997, costs of outpatient services increased 26 percent per year (Liu 2001), while on average 20 percent of urban individuals forego inpatient services recommended by health professionals because they cannot afford them (Center for Health Statistics and Information 1999). Aiming at solving this inequity problem and trying to control the cost escalation of the health care services, the Chinese government has implemented a series of reforms in the health care system.

The Chinese health care system reform contained three main stages: the first stage, between 1980 and 1991, had the cost containment as its primary objective; the second stage, between 1991 and 1998, addressed the inadequate risk pooling and implemented some pilot programmes in selected areas; the third stage, which occurred at the end of 1998, constructed the Basic Insurance Scheme (BIS), which replaced the previous LIS and GIS. Compared with LIS and GIS, BIS expanded the coverage not only to SOEs, the governments, and the institutions, but also to private and small public enterprises. Self-employees could enroll in BIS but the enrollment was not

compulsory. BIS was financed by premium contributions of both the employer and the employee; retiree were exempt from the premium contributions and the cost of their contributions was to be borne by their former employers (Liu 2002, Brugiavini, Weber and Wu 2010).

Few papers have examined the effect of the health care system reform on the out-of-pocket expenses and the household saving rate. The population covered by LIS and GIS declined significantly between 1993 and 1998. The out-of-pocket expenses increased from 28 percent in 1993 to 44 percent in 1998. Lowest income group was reluctant to obtain the medical treatment, and the most important reason was financial difficulties. The health service has worsen and has become more inequitable since the early 1990s (Gao et al. 2001). Some studies use a two-step estimation procedure to show that the public health insurance positively affect the out-of-pocket expenses. People covered by the public insurance are more likely to move up the medical provider “ladder”, such as hospitals. The hospitals deliver more costly tests, drugs, and medical interventions to people who have public insurance coverage (Wagstaff and Lindelow 2008). Few other papers have examined the relation between the household’s health risk and the saving rate. Chamon and Prasad (2010) find that an older household with health risk saves 5 percent more of its income than the younger household. The health risk can partially explain why the saving rate for the older household increased from the 1990s to the 2000s.

This paper focuses on the third stage of the health care system reform and tries to explore the 1998 reform effect on the household saving rate and the out-of-pocket expenses. The remainder of this paper is organized as follows: Section 2 reviews the institutional background of the health care system in different periods. Section 3 focuses on the data set, the empirical model as well as the estimation results. Finally in section 4, we conclude.

3.2 Institutional Background

The health care reform in urban China brought about the socioeconomic change as well as the health system deficiencies. In the following paragraphs we review the institutional background of the health care system in different periods.

3.2.1 Health Care System before 1980

Before 1980, GIS and LIS have played an important role in providing the urban employees with the health protection. GIS mainly served the employees of the governments and the institutions, and LIS mainly covered the SOEs employees. Both GIS and LIS were the third-party insurance, which provided comprehensive benefits with minimal cost sharing to constrain beneficiaries on their consumption of medical services. The beneficiaries could receive the free outpatient and inpatient services provided by health care organizations constructed by the employers, and the employees' dependents were reimbursed 50 percent for their health expenditures (Liu 2002). Each organization under the original GIS and LIS was self-insured. Moreover, the GIS and LIS beneficiaries could also seek public medical care providers, such as public hospitals. The beneficiaries who were using the services provided by the public hospitals were reimbursed on a fee-for-service system (Grogan 1995, Liu and Wang 1991, Hsiao 1995 and Ho 1995.). In fact, there existed some differences between GIS and LIS. The governments and institutions could apply for the health care funds from the central government according to the number of their employees, whereas SOEs had to use part of their profits to reimburse the employees' health care bills.

The main problem of GIS and LIS was the lack of risk pooling, since each employer only born all medical care costs of its own employees. This problem was not clearly observed before 1978 and both GIS and LIS have performed well. However, after China started the economic reform, LIS faced a big challenge. Some SOEs were

running a deficit and could not provide sufficient capital to reimburse their LIS beneficiaries' basic medical expenses. If SOEs were bankrupt, their former employees became uninsured. Even if SOEs were in a profitable situation, their beneficiaries' health care costs imposed heavy financial burdens to them, which would seriously harm their ability to compete in the market economy. On the contrary, the performance of GIS did not change after 1978, since the central government still provided the health care funds to fulfill the GIS beneficiaries's health care needs. Inevitably, there existed an inequity in the health care expenses between the employees covered by LIS and GIS. Meanwhile, the costs of the medical treatments, the medicines, and the hospitalizations have increased substantially. To solve the inequity problem and the cost escalation, the Chinese government started to implement a series of reforms in the urban health care system at the beginning of the 1980s. The urban health care system reform included three main stages: the first stage was between the early 1980s and 1991; the second stage started in 1991; and the third stage began in 1998.

3.2.2 First and Second Stages of Health Care Reform

The first stage of the health care reform was between 1980 and 1991. Its primary objective was the cost containment. Major reform measures included the introduction of the cost sharing both on the demand-side and the supply-side. Before 1985, the health care reform mostly targeted the introduction of co-payments to make the beneficiaries more cost-consciousness when accessing medical services. From 1985 to 1991, the focus turned to the control of medical care providers, especially the economic incentives to hospitals. One experiment with the supply-side cost sharing reform included the pre-payment to the hospitals according to the number of the beneficiaries in their areas, and specifying a fixed fee for services. Another supply-side reform measure was to define a limited list of drugs for which the GIS beneficiaries would be reimbursed. In addition to these experiments with the demand-side and the

supply-side cost sharing, efforts were made to improve the management of GIS and LIS, such as setting the maximal amount of the health care reimbursement.

These measures played a role in mitigating the China's rapid health care cost escalation and relieved some of the financial pressures on SOEs. They also eliminated the inequity of the health care expenses between SOEs and the government agencies and institutions. The first stage of the health sector reform neither tackled the medical cost escalation nor other fundamental weakness that existed in financing, payment and management within GIS and LIS.

Since 1992, the focus of the health sector reform has shifted to more fundamental problems, like increasing the level of "socialization" (Liu 2002) or the risk pooling with the original objective of the cost containment. At the same time the problem of inefficiency and inequity became inevitable. In 1992, Shenzhen became the first city to implement the citywide health insurance reform that eventually paved the way for a new phase of pilot programs in cities. In early 1995, Jiujiang and Zhenjiang began their city pilot programs that use a combination of individual savings and the social risk-pooling fund to finance the beneficiaries' medical expenses. The social risk pooling component of the new system drew on strengths of the social insurance to spread the risk of catastrophic medical expenses. This model combined the individual responsibility with the social protection through the citywide risk pooling for the GIS and LIS beneficiaries.

In December 1996, China held its first National Health Conference to develop major health policies for the next decade. The key measures decided in the conference were closely tied to guiding principles of the health insurance reform: the establishment of an effective mechanism for controlling the health care demand and supply; the development of the appropriate payment method to control the excessive health care cost growth; and the gradual extension of the health insurance coverage to all the urban employees.

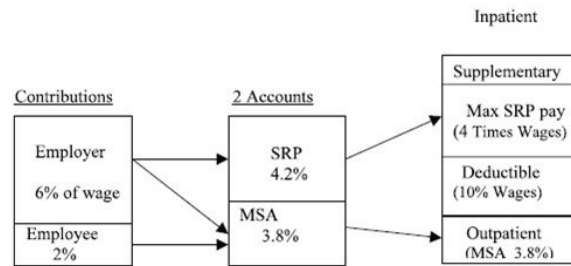


Fig. 1. Funding and benefit structure of the social insurance program.

3.2.3 Third Stage of Health Care Reform

Followed the key measures determined in the first National Health Conference, the State Council issued the regulatory document “The Decision of the State Council on Setting up Basic Medical Insurance System for Staff Members and Workers in Cities and Towns”, which marked the establishment of BIS all over the country. BIS replaced the existing LIS and GIS nationwide and expanded the coverage to a broader scale, where the employees of private and small public enterprises were also included. Self-employed and rural industry employees could buy into the program, but they were not required to enroll. BIS did not cover its contributors’ dependents any more.

BIS was financed by premium contributions from both the employer and the employee, where the employer on average contributed 6 percent of the employee’s wage and the employee contributed 2 percent of his/her wage.¹ Retirees were exempt from the premium contributions and the cost of the contributions was to be borne by their former employers. The Job Retraining Center at each SOE was responsible for paying the premium contributions of the laid-off employees. BIS financed the beneficiaries’ health care services through three tiers: individual medical saving accounts (MSAs), the out-of-pocket spending by the contributors in the form of deductibles, and the social risk pooling. Figure 1 shows the funding and the benefit structure of the social insurance program as presented in Liu (2002).

¹The amount of the employer’s contribution was different across provinces and cities. 6 percent of the employee’s wage was the average level.

The total contributions (on average 8 percent of the employee's wage) were divided into two accounts, where 3.8 percent went into MSA, and each contributor could only use his MSA for the health care expenses; the rest 4.2 percent went into the Social Risk Pooling (SRP) fund, which was used to cover the large medical expense. The government at the city level had the right to decide that SRP had to cover only inpatient expenses or catastrophic expenses, defined as the expenditure that has exceeded a certain large deductible. In a typical BIS benefit structure, the contributor was expected to pay all of his outpatient medical expenses out of MSAs until the funds have been depleted. The unused MSA funds at the end of the year were carried over to the next year, and the unused funds at the end of a person's life became a part of his bequest. When MSA exhausted, the contributor had to pay the outpatient expenses out-of-pocket. When the contributor incurred the inpatient expenses, he had to pay first a deductible that was equal to 10 percent of his annual wage. The expenses exceeding the deductible were paid by SRP, which limited the payment for each contributor to four times the average wage of the employees in that city. The inpatient expenses exceeding this ceiling could be covered by other supplementary insurance schemes, or had to be paid by the patient out-of-pocket. The governments provided other supplementary insurance schemes for their employees. Other employers may purchase supplementary insurance for their employees. The employees can also purchase the supplementary private insurance individually.

Each local government at the city level had to establish the Social Insurance Bureau (SIB), which was responsible for collecting the premium, contracting the payment for services. SIB, working with health authorities, accredited and contracted with a set of health care providers, including outpatient clinics, pharmacies, and hospitals. The central government did not specify the exact payment method to be used by SIBs to pay the health care providers, but it required the risks were to be

pooled at the city level and the local governments were responsible for making up any deficits.

3.2.4 LIS and GIS vs BIS

Compared with GIS and LIS, the benefit structure under BIS has two major differences in the coverage. First, the BIS contributors' dependents, who used to receive partial coverage, are now not covered. Second, BIS has a ceiling on the insured amount of the individual medical expenditures (equivalent to four times the average wage in the region). The imposition of this ceiling is due to budget constraints as well as the political emphasis on the wide coverage but it leaves most catastrophic illnesses uncovered. It is estimated that the premium contributions based on the 8 percent of the current wage bill can only cover about 70 percent of the total outlay under the old systems of GIS and LIS (Ministry of Labor and Social Security, 1999). Moreover, Gao et al. (2007) show that the proportion of elderly covered by the health insurance in urban China has declined over the period 1998-2007. This may be attributed to the reform of SOEs, which has resulted in many enterprises being closed and a substantial number of workers being laid-off (Gao et al. 2001). As the Chinese government has only guaranteed the minimum living allowance, the elderly who were laid off or whose employing enterprises were closed (as a result of the ongoing economic reforms process) may have lost their entitlements such as health insurance.

3.3 Data and Empirical Analysis

3.3.1 Data and Stylized Facts

We use two waves of the Chinese Household Income Project Survey (CHIPS) in 1995 and 2002. The objective of this paper is to explore the 1998 health care reform effect on the household saving rate and the out-of-pocket expenses. Our interesting

variables in the empirical analysis are the household saving rate and the out-of-pocket expenses. We use the standard definition of the household saving rate and the out-of-pocket expense is defined as the difference between total household's health care expenditure and the amount of the reimbursement by any insurances.²

We use the household head's information as a proxy of the household and restrict the sample to the heads that aged between 25 and 65. The household head can be covered by the public insurance, the private insurance, and no insurance. In the 2002 wave the public health insurance refers to BIS, whereas in the 1995 wave it indicates either LIS or GIS. In addition, we take into account the household head's health status. In the 2002 wave, there are a subjective proxy of the household head's own cognition of the health status, which can be very good, good, just so so and bad, and an objective proxy, which is the number of symptoms.³ However, in the 1995 wave we cannot find a good proxy of the health status.⁴

We consider the household composition, such as the household size and whether the household has any children or not; welfare proxies, such as the head's education level and the income level; and the employment characteristics, including working years in the current work place, permanent employed or not, working in any enterprises or not, and economic sectors. In practice, we construct the dummy for the permanent employment, that takes value 1 if the head is permanent employed, and 0 otherwise; and the dummy of enterprises takes value 1 if the household head is working in the enterprises, such as SOEs, urban collective enterprises, etc., and 0 if

²Household i 's saving rate: $sr_i = 1 - \frac{\text{household's expenditure}}{\text{household's disposable income}}$. According to Brugiavini and Padula 2001 and Brugiavini and Weber 2003, disposable income traces all social security contributions as taxes. In 1995 GIS and LIS did not require the beneficiaries to contribute, whereas in 2002 BIS required the beneficiaries to contribute. The BIS contribution is excluded from the disposable income. Any insurances indicate the public insurance and the private insurance.

³Symptoms include the disability or hemiplegia, the obstacle in eyesight, the obstacle in hearing and speaking, the psychopathic, the retarded, the frail, the chronically diseased, and other physical disabilities.

⁴In fact, in the 1995 wave there is a variable which asks the household member to report the number of days being out of work due to illness. However, this variable has too many missing values. Therefore, we decide to not to use it.

Table 3.1: Descriptive Statistics of Relevant Variables

Panel A: The out-of-pocket expenses and insurance coverage.

Variable Name	1995	2002	P-value
Saving rate	12.64(0.2437)	18.41(0.2850)	0.0000
Out-of-pocket expenses	140.00(454.30)	370.33(982.72)	0.0000
Public insurance	0.7099(0.4538)	0.6668(0.4713)	0.0008
Private insurance	0.0882(0.2836)	0.0171(0.1296)	0.0004
No insurance	0.2018(0.4013)	0.3160(0.4649)	0.0000

Panel B: Health status in the 2002 wave.

Health status	Mean	Std. Dev.	Number of symptoms	Frequency	Percent
Very good	0.2215	0.4152	0	6803	73.38
Good	0.4013	0.4901	1	1689	18.22
Just soso	0.3204	0.4666	2	505	5.45
Bad	0.0566	0.2312	≥ 3	274	2.95

Notes: In Panel A the average out-of-pocket expenses are in terms of the 2011 US dollar. They are computed as follows: first adjust the out-of-pocket expenses in 1995 and 2002 by CPI to the 2011 level; second transfer the out-of-pocket expenses at 2011 level to equivalent US dollar by using PPP. The source of PPP is IMF. The public insurance in the 1995 wave indicates either LIS or GIS, and that in the 2002 wave means BIS. The last column of Panel A shows P-value of the difference of each variable between 1995 and 2002. All of them are statistically significant at 5 percent level. In addition, in each wave the differences between each two insurance statuses are statistically significant at 5 percent level. In Panel B, the health status variable is the dummy variable. The differences between each two health statuses are statistically significant at 5 percent level.

the head is employed by the governments and institutions.⁵ In Table 3.1 we provide the descriptive statistics of the saving rate, the out-of-pocket expenses, the insurance status and the health status in the 2002 wave; the descriptive statistics of other relevant variables are reported in Table 3.2.

We can observe that the average out-of-pocket expenses increased significantly from 1995 to 2002, which is consistent with the findings of Gao et al. (2001) and Wagstaff and Linderlow (2008). The significant growth of the out-of-pocket expenses could be due to two main reasons. First, in 1995 the health care costs of the LIS and BIS beneficiaries' dependents could be partially reimbursed, whereas in 2002 BIS did not reimburse the dependents' health care costs any more. Second, there was a health care cost escalation, which lead to higher household expenses. Moreover, the proportion of the public insurance coverage decreased from 1995 to 2002 significantly. This result is not surprising, since the Ministry of Labor and Social Security (1999) reported that BIS could only cover 70 percent of the total outlay under GIS and LIS.

⁵We also use the household composition variables, the employment characteristics variables in Chapter 2 and the definitions of these variables are exactly the same.

Table 3.2: Descriptive Statistics of Other Relevant Variables

Panel A: Dummy Variables

Variable Name	1995	2002	P-value
Dummy of any children	90.20(0.2974)	85.68(0.3503)	0.0000
Dummy of enterprises	64.79(0.4777)	59.70(0.4906)	0.0000
Dummy of permanent employed	82.56(0.3795)	58.56(0.4927)	0.0000

Panel B: Continuous Variables

Variable Name	1995	2002	P-value
Age	42.0(8.37)	43.4(7.60)	0.0000
Household size	3.2(0.71)	3.0(0.65)	0.0000
Disposable income	5150.08(3012.56)	7930.93(4917.69)	0.0000
Per capita income	1678.38(1061.36)	2559.43(1701.14)	0.0000
Education years	10.86(3.00)	11.28(3.02)	0.0002
Working years in current unit	17.30(8.94)	16.88(9.79)	0.0003

Notes: All the values are computed from CHIPS. Standard deviations are in parentheses. For all the dummy variables in Panel A, the means are also equal to the proportion if the dummy variables take value 1. In Panel B, the average disposable income is given in terms of 2011 US dollar. They are computed as follows: first adjust the out-of-pocket expenses in 1995 and 2002 by CPI to the 2011 level; second transfer the out-of-pocket expenses at 2011 level to equivalent US dollar by using PPP. The source of PPP is IMF.

This may be attributed to the reform of SOEs, which has resulted in many enterprises being closed and a substantial number of workers being laid-off (Gao et al. 2001). In Panel B, we observe that most household heads have good or very good health status, accounting for 62 percent of total observations, and 73 percent of the household heads do not have any big health problems.

Table 3.2 contains two panels, where Panel A shows the descriptive statistics for dummy variables and Panel B shows the descriptive statistics for continuous variables. From Panel B we can observe that the household's disposable income has increased significantly from 1995 to 2002, which is consistent with the findings of Chamon and Prasad (2010). Next, in Table 3.3 we present some stylized facts, including the saving rate and the out-of-pocket expenses conditional on the insurance coverage.

Panel A and B of Table 3.3 show that both the saving rate and the out-of-pocket expenses have increased significantly from 1995 to 2002 if the head is covered by the public insurance. In 1995, the health care costs of the households' heads could be reimbursed entirely and those of their dependents' could be partially reimbursed if the head is covered by LIS or GIS. However, in 2002 the public insurance (BIS) reimbursed all the household head's outpatient costs only if the costs are less than

Table 3.3: Saving rate and out-of-pocket expenses conditional on insurance status

Panel A: Saving rate conditional on insurance status.			
Variable Name	1995	2002	P-value
Public insurance	0.1288(0.2445)	0.2025(0.3380)	0.0000
Private insurance	0.1227(0.2363)	0.1389(0.4227)	0.0565
No insurance	0.1310(0.2482)	0.1287(0.3958)	0.0313
Panel B: Out-of-pocket expenses conditional on insurance status.			
Variable Name	1995	2002	P-value
Public insurance	155.52(512.05)	399.90(1105.20)	0.0000
Private insurance	167.78(316.14)	385.35(697.01)	0.0000
No insurance	143.17(248.36)	324.57(784.03)	0.0000

Notes: In both Panel A and B, each insurance status is the dummy variable. In Panel B the average out-of-pocket expenses for a given insurance status are in terms of the 2011 US dollar. The method is exactly the same to the average out-of-pocket expenses reported in Table 3.1.

the medical saving accounts (MSAs); and the BIS contributors always have to pay the deductibles if they use inpatient services. In addition, the hospitals delivered the high-tech and high cost tests, treatments, and drugs to patients covered by GIS (Wagstaff and Linderlow 2008). The households with their heads covered by the public insurance in 2002 would have the higher out-of-pocket expenses and thus had the precautionary saving motives.

3.3.2 Empirical Analysis

The objective of this paper is to determine the 1998 health care reform effect on the saving rate and the out-of-pocket expenses. The public insurance coverage is endogenous, since it might be affected by some unobservable variables. The ideal approach would be to adopt a two-step estimation procedure, which requires valid instrumental variables. A valid instrumental variable could be the number of medical providers or the number of medical technical persons at the city level. According to our knowledge, not all these variables are available for all the 11 provinces in the 1995 wave, while these variables are available for all the provinces in the 2002 wave.⁶ In addition, since the 1995 wave does not provide the proxy of the health status, we

⁶In fact, we can obtain the number of medical providers or the number of the number of medical technical personnel for the cities of 5 provinces, whereas these variables of the cities of the rest 6 provinces are not available.

consider the 1995 wave and the 2002 wave separately. We explore the public insurance coverage effects on the out-of-pocket expenses and the saving rate in 1995 using the simple OLS estimation procedure and those in 2002 using the two-step estimation procedure. We estimate the following estimation functions for the saving rate and the out-of-pocket expenses for 1995:

$$sr_{i,95} = \alpha \cdot PI_{i,95} + \beta \cdot X_{i,95} + \mu_{i,95}; \quad (3.1)$$

$$oop_{i,95} = \gamma \cdot PI_{i,95} + \omega \cdot X_{i,95} + \epsilon_{i,95}. \quad (3.2)$$

The dependent variables in Equation 3.1 and 3.2 are the household i 's saving rate and the out-of-pocket expenses in 1995, respectively. The variable $PI_{i,95}$ is the dummy of the public insurance, which takes 1 if the household head is covered by LIS or GIS in 1995, and takes 0 otherwise. $X_{i,95}$ is the vector of control variables, which includes the household head's demographic characteristics (age and age square), the household's composition (the household size and the dummy of any children), the welfare proxies (the per capita income and years of education) and the employment characteristics (working in the enterprises or in the governments and the institutions, the dummy of permanent employed, working years in the current unit and the dummies of economic sectors) and the province dummies.

For the 2002 wave, we use the two-step estimation procedure introduced by Maddala (1983). The primary interests are the saving rate and the out-of-pocket expenses in regression functions:

$$sr_{i,02} = \alpha \cdot PI_{i,02} + \delta \cdot HS_{i,02} + \beta \cdot X_{i,02} + \mu_{i,02}; \quad (3.3)$$

$$oop_{i,02} = \gamma \cdot PI_{i,02} + \theta \cdot HS_{i,02} + \omega \cdot X_{i,02} + \epsilon_{i,02}. \quad (3.4)$$

$PI_{i,02}$ is the endogenous public insurance, which takes value 1 if the household head is covered by GIS, and 0 otherwise. We also include the proxy of the household

head's health status ($HS_{i,02}$) in the 2002 wave and we use both the subjective proxy (the household head's subjective choice among very good, good, just so-so and bad) and the objective proxy (the number of symptoms). $X_{i,02}$ contains the same control variables as those in $X_{i,95}$. $\mu_{i,02}$ and $\epsilon_{i,02}$ are error terms and assumed to satisfy normal distributions $N(0, \sigma_{sr}^2)$ and $N(0, \sigma_{oop}^2)$, respectively.

In the two-step estimation procedure, the public insurance coverage $PI_{i,02}$ is modeled as the outcome of an unobserved latent variable, $PI_{i,02}^*$. It is assumed that $PI_{i,02}^*$ is a linear function of the exogenous covariates $W_{i,02}$, $X_{i,02}$, the proxy of the health status $HS_{i,02}$ and a random component $e_{i,02}$. $W_{i,02}$ represents the vector of instrumental variables, which are assumed to affect the public insurance coverage but not the saving rate and the out-of-pocket expenses. We use the number of health care providers per 1000 persons of each city and the number of the medical technical persons per 1000 persons, which are assumed to be exogenous, affect the public insurance coverage, but not affect the saving rate and the out-of-pocket expenses.⁷ $e_{i,02}$ is assumed to satisfy the normal distribution $N(0, 1)$. Specifically,

$$PI_{i,02}^* = \kappa \cdot W_{i,02} + \tau \cdot HS_{i,02} + \nu \cdot X_{i,02} + e_{i,02};$$

⁷The number of health care providers per 1000 persons of each city is defined as (the number of all the health care providers in the city level/the population of the city) \times 1000. The health care providers in each city include both the public health institutions, such as the hospitals, and the private health care institutions, such as clinics. Similarly, the medical technical persons per 1000 persons of each city is equal to (the number of all the medical technical persons in the city/the population of the city) \times 1000. Almost all these variables are available in provincial statistical yearbooks 2003. In addition, in the 2002 wave, the information collected for Yunnan province contains 3 cities (Kunming, Qujing and Baoshan) and 4 Minority Autonomous regions (Honghe, Simao, Dali and Lijiang). The Yunnan Statistical Yearbook 2003 provides the numbers of the health care providers and of the medical technical persons for these 3 cities and aggregate numbers of the health care providers and of the medical technical persons for all the Minority Autonomous regions. We assume that the health care providers and the medical technical persons uniformly distributed in the Minority Autonomous regions. The Hubei Statistical Yearbook 2003 does not provide the number of the health care providers and that of the medical technical persons in each city. They are available in the Annual Report of Hubei Health Development (2003 and 2004). Now, we can only assume that they are valid instrumental variables and we will provide the validity test after the two-step estimation procedure.

and observed decision is

$$PI_{i,02} = \begin{cases} 1, & \text{if } PI_{i,02}^* > 0 \\ 0, & \text{otherwise} \end{cases} \quad (3.5)$$

$$(3.6)$$

The covariance matrix of $\mu_{i,02}$ and $e_{i,02}$ is:

$$\begin{pmatrix} \sigma_{sr} & \rho_{sr} \\ \rho_{sr} & 1 \end{pmatrix}$$

We thus rewrite Equation (3.3) by combining the PI^* effects given by Equation (3.5) and (3.6):

$$sr_{i,02} = \alpha + \delta \cdot HS_{i,02} + \beta \cdot X_{i,02} + \mu_{i,02},$$

$$if : PI_{i,02}^* > 0 (i.e. - e_{i,02} < \kappa \cdot W_{i,02} + \tau \cdot HS_{i,02} + v \cdot X_{i,02}),$$

and

$$sr_{i,02} = \delta \cdot HS_{i,02} + \beta \cdot X_{i,02} + \mu_{i,02},$$

$$if : PI_{i,02}^* \leq 0 (i.e. - e_{i,02} \geq \kappa \cdot W_{i,02} + \tau \cdot HS_{i,02} + v \cdot X_{i,02}).$$

Hence,

$$E(sr_{i,02} | PI_{i,02} = 1)$$

$$= \alpha + \delta \cdot HS_{i,02} + \beta \cdot X_{i,02} + E(\mu_{i,02} | -e_{i,02} < \kappa \cdot W_{i,02} + \tau \cdot HS_{i,02} + v \cdot X_{i,02})$$

$$= \alpha + \delta \cdot HS_{i,02} + \beta \cdot X_{i,02} + \rho_{sr} \sigma_{sr} \cdot \frac{\phi(\cdot)}{\Phi(\cdot)}. \quad (3.7)$$

$$E(sr_{i,02} | PI_{i,02} = 0) = \delta \cdot HS_{i,02} + \beta \cdot X_{i,02} - \rho_{sr} \sigma_{sr} \cdot \frac{\phi(\cdot)}{1 - \Phi(\cdot)}; \quad (3.8)$$

where $\phi(\cdot)$ and $\Phi(\cdot)$ are the density function and the cumulative distribution function of the standard normal evaluated at $(\kappa \cdot W_{i,02} + \tau \cdot HS_{i,02} + v \cdot X_{i,02})$. We define $\lambda = \frac{\phi(\cdot)}{1-\Phi(\cdot)}$ for further analysis.

The difference in saving rate between $PI_{i,02} = 1$ and $PI_{i,02} = 0$ is:

$$E(sr_{i,02}|PI_{i,02} = 1) - E(sr_{i,02}|PI_{i,02} = 0) = \alpha + \frac{\rho_{sr}\sigma_{sr}\lambda}{1 - \Phi(\cdot)}.$$

Equation (3.7) suggests that the following two-stage estimation procedure. We first get probit Maximal Likelihood estimates $\hat{\kappa}$, $\hat{\tau}$ and \hat{v} for κ , τ and v . We also compute λ .

Furthermore, we should note that by combining the two equations (3.7) and (3.8), we get:

$$\begin{aligned} E(sr_{i,02}) &= E(sr_{i,02}|PI_{i,02} = 1) \cdot Prob(PI_{i,02} = 1) + E(sr_{i,02}|PI_{i,02} = 0) \cdot Prob(PI_{i,02} = 0) \\ &= \alpha \cdot \Phi(\cdot) + \delta \cdot HS_{i,02} + \beta \cdot X_{i,02}. \end{aligned}$$

Similarly,

$$\begin{aligned} E(oop_{i,02}|PI_{i,02} = 1) &= \gamma + \theta \cdot HS_{i,02} + \omega \cdot X_{i,02} + \rho_{oop}\sigma_{oop} \cdot \frac{\phi(\cdot)}{\Phi(\cdot)}; \\ E(oop_{i,02}|PI_{i,02} = 0) &= \theta \cdot HS_{i,02} + \omega \cdot X_{i,02} - \rho_{oop}\sigma_{oop} \cdot \frac{\phi(\cdot)}{1 - \Phi(\cdot)}; \\ E(oop_{i,02}|PI_{i,02} = 1) - E(oop_{i,02}|PI_{i,02} = 0) &= \gamma + \frac{\rho_{oop}\sigma_{oop}\lambda}{1 - \Phi(\cdot)}; \\ E(sr_{i,02}) &= \gamma \cdot \Phi(\cdot) + \theta \cdot HS_{i,02} + \omega \cdot X_{i,02}; \end{aligned}$$

where $\rho_{oop} = Cov(\epsilon_{i,02}, e_{i,02})$.

3.3.3 Results

The results of the OLS estimation for the out-of-expenses and the saving rate in 1995 are reported in Table 3.4.⁸ In Column (1) we observe that in 1995 the public insurance coverage has a negative and significant effect on the out-of-pocket expenses. It implies that the households have less out-of-pocket expenses if their heads are covered by the public insurance. Since in 1995 the public insurance (LIS or GIS) reimbursed the beneficiaries' health care expenses entirely and those of their dependents partially, the households with the heads covered by the public insurance did not have to spend more on the health care. In Column (2) we observe that the public insurance coverage has the negative and significant coefficient of -0.0181. It indicates that the households saved less if the heads were covered by LIS or GIS. This result is consistent with the finding of the out-of-pocket expenses. If the heads were covered by the public insurance, the households had less out-of-pocket expenses and did not have as strong precautionary saving motives as those with the heads covered by the private insurance or none. The results suggest that in 1995 the public insurance served as a cushion against the health risk, reducing the out-of-pocket expenses and the need to save for precautionary motive.

We now explore the determinants of the household out-of-pocket expenses and the saving rate in 2002. The results of the two-step estimation procedure of the out-of-pocket expenses, in which the subjective health proxy (very good, good, and just so-so vs. bad) is considered, are reported in Table 3.5. We use either the number of the health care providers per 1000 persons or the number of the medical technical persons per 1000 persons as the instrumental variable. Column (2) reports the results of the second step estimation and Column (3) reports the first step marginal effects

⁸In all the following specifications, the unit of the household out-of-pocket expenses is Yuan in real term. The 1995 CPI level is the baseline and assumed to be 100, and the CPI level in 2002 is 110.6. In 1995, 100 Yuan was equivalent to 35.34 US dollar in 2011. In order to read the estimation results easily, we use the household out-of-pocket expenses divided by 1000 (OOP/1000). In all the following estimation specifications of the out-of-pocket expenses, we use OOP/1000.

Table 3.4: Out-of-pocket Expenses and Saving Rate in 1995

VARIABLES	(1) OOP/1000	(2) sr
Dummy of public insurance	-0.0269* (0.0163)	-0.0181** (0.00768)
Age	-0.00753 (0.00653)	-0.00873*** (0.00306)
Age square	0.000116 (7.21e-05)	9.96e-05*** (3.38e-05)
Household size	0.0915*** (0.0109)	0.0263*** (0.00518)
Dummy of any children	-0.0699*** (0.0271)	0.0127 (0.0126)
Education years	0.00671*** (0.00240)	-0.00135 (0.00114)
Per capita income	1.63e-05*** (3.04e-06)	2.65e-05*** (1.34e-06)
Working years	-3.11e-06 (0.000903)	0.000324 (0.000426)
Permanent employment	0.000727 (0.0196)	0.00854 (0.00923)
Dummy of enterprises	-0.0504** (0.0234)	-0.00622 (0.0109)
Economic sector	YES	YES
Dummy of Beijing	-0.0272 (0.0398)	-0.0536*** (0.0191)
Dummy of Shanxi	-0.126*** (0.0364)	0.0329* (0.0177)
Dummy of Liaoning	0.0220 (0.0356)	-0.0649*** (0.0173)
Dummy of Jiangsu	-0.141*** (0.0363)	-0.0425** (0.0175)
Dummy of Anhui	-0.158*** (0.0389)	-0.0341* (0.0183)
Dummy of Henan	-0.0377 (0.0363)	-0.0108 (0.0177)
Dummy of Hubei	-0.000198 (0.0360)	-0.0437** (0.0175)
Dummy of Guangdong	0.0531 (0.0397)	-0.161*** (0.0193)
Dummy of Sichuan	0.0188 (0.0346)	-0.0949*** (0.0169)
Dummy of Yunnan	0.135*** (0.0350)	-0.0153 (0.0172)
Constant	0.0658 (0.168)	0.179** (0.0791)
Observations	4,674	5,411
R-squared	0.067	0.090

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

if the instrumental variable is the number of the health care providers per 1000 persons, while Column (4) reports the results of the second step estimation and Column (5) reports the first step marginal effects if the instrumental variable is the number of the medical technical persons per 1000 persons. Besides the results of the two-step estimation specifications, we also report the OLS estimation results ignoring the endogeneity problem induced by the public insurance coverage and the instrumental effects in the first column.

The public insurance coverage has a positive and significant coefficient of 0.405 after the 1998 health care reform. It indicates that the households with the heads covered by the public insurance (BIS) on average spends 405 Yuan (equivalently 143.11 US dollar in 2011) more on health care services. These results are consistent with the findings of Wagstaff and Linderlow (2008), where the public insurance coverage positively and significantly affects the out-of-pocket expenses. This is probably due to the fact that the BIS contributors have to pay the outpatient expenses out-of-pocket if the medical saving accounts (MSAs) are exhausted. If the BIS contributors used the inpatient services, they firstly had to pay the deductibles (10 percent of his annual wage) out-of-pocket. Moreover, if the contributors' inpatient costs exceeded the deductibles and a ceiling determined by the local government (in general four times of the average wage of the employees in the city), they have to pay the rest inpatient costs out-of-pocket. The health care costs of the BIS contributors' dependents could not be reimbursed any more after 1998. With respect to the bad health status, the households with their heads being in the not-bad health status have less out-of-pocket expenses. Ignoring the endogeneity problem induced by the public insurance coverage may result in a selection bias. In the second step regression, the significant coefficient of λ implies that the endogeneity problem induced by the public insurance coverage does exist and the two-step estimation resolves it. From Column (1) we can observe

Table 3.5: Out-of-pocket Expenses in 2002: Subjective Proxy of Health Status

VARIABLES	(1) OOP/1000 OLS	(2) OOP/1000 Second Step	(3) PI First Step ME	(4) OOP/1000 Second Step	(5) PI First Step ME
No. of health providers per 1000 persons			-0.114*** (0.0307)		
No. of beds per 1000 persons					-0.00314* (0.00112)
Dummy of public insurance	-0.000695 (0.0340)	0.405* (0.212)		0.489** (0.228)	
Health status: very good	-0.918*** (0.0780)	-0.910*** (0.0787)	-0.0171 (0.0334)	-0.953*** (0.0829)	-0.0420 (0.0356)
Health status: good	-0.904*** (0.0752)	-0.922*** (0.0763)	0.0574* (0.0312)	-0.968*** (0.0799)	0.0473 (0.0328)
Health status: just so so	-0.739*** (0.0763)	-0.750*** (0.0771)	0.0351 (0.0314)	-0.794*** (0.0808)	0.0156 (0.0334)
Age	-0.0815*** (0.0188)	-0.0802*** (0.0189)	-0.00764 (0.00792)	-0.0808*** (0.0194)	-0.00555 (0.00810)
Age square	0.00105*** (0.000215)	0.00104*** (0.000217)	8.20e-05 (9.12e-05)	0.00106*** (0.000222)	5.60e-05 (9.31e-05)
Household size	0.311*** (0.0247)	0.322*** (0.0256)	-0.0299*** (0.0101)	0.335*** (0.0264)	-0.0198* (0.0106)
Dummy of any children	-0.188*** (0.0530)	-0.218*** (0.0555)	0.0992*** (0.0249)	-0.246*** (0.0573)	0.0914*** (0.0254)
Per capita income	2.40e-05*** (3.40e-06)	1.83e-05*** (4.52e-06)	1.90e-05*** (1.65e-06)	1.69e-05*** (4.68e-06)	1.90e-05*** (1.67e-06)
Education years	0.0165*** (0.00537)	0.00988 (0.00640)	0.0176*** (0.00228)	0.00841 (0.00683)	0.0181*** (0.00238)
Working years	-0.00234 (0.00178)	-0.00632** (0.00273)	0.0107*** (0.000736)	-0.00736** (0.00286)	0.0106*** (0.000758)
Permanent employment	0.0351 (0.0339)	-0.0302 (0.0480)	0.174*** (0.0141)	-0.0465 (0.0510)	0.175*** (0.0145)
Dummy of enterprises	0.0439 (0.0434)	0.0150 (0.0462)	0.0824*** (0.0187)	-0.00235 (0.0482)	0.0794*** (0.0193)
Economic sector	YES	YES	YES	YES	YES
Dummy of Beijing	0.258*** (0.0806)	0.206** (0.0854)	0.152*** (0.0254)	0.192** (0.0872)	0.161*** (0.0258)
Dummy of Shanxi	-0.145** (0.0727)	-0.0896 (0.0786)	-0.180*** (0.0353)	-0.0774 (0.0807)	-0.180*** (0.0356)
Dummy of Liaoning	0.0758 (0.0716)	0.0733 (0.0721)	-0.0412 (0.0339)	0.0693 (0.0731)	-0.000661 (0.0308)
Dummy of Jiangsu	-0.327*** (0.0734)	-0.272*** (0.0791)	-0.197*** (0.0368)	-0.263*** (0.0809)	-0.173*** (0.0359)
Dummy of Anhui	-0.194** (0.0767)	-0.204*** (0.0774)	0.0150 (0.0335)	-0.208*** (0.0785)	0.0364 (0.0320)
Dummy of Henan	-0.0629 (0.0717)	-0.0413 (0.0731)	-0.0978*** (0.0348)	-0.0383 (0.0742)	-0.0664** (0.0328)
Dummy of Hubei	0.0861 (0.0717)	0.0726 (0.0725)	-0.00257 (0.0317)	0.0681 (0.0735)	0.0249 (0.0297)
Dummy of Guangdong	0.150** (0.0759)	0.156** (0.0766)	0.00493 (0.0333)	0.152* (0.0777)	-0.00498 (0.0375)
Dummy of Chongqing	0.0583 (0.0889)	0.0326 (0.0905)	0.0427 (0.0363)	0.0248 (0.0918)	0.0616* (0.0349)
Dummy of Sichuan	-0.0185 (0.0742)	-0.0430 (0.0758)	0.0606** (0.0285)	-0.0519 (0.0769)	0.0666** (0.0286)
Dummy of Yunnan	-0.0495 (0.0727)	-0.0865 (0.0757)	0.0701** (0.0289)	-0.107 (0.0874)	0.0830*** (0.0318)
lambda		-0.241* (0.124)		-0.290** (0.133)	
Constant	1.972*** (0.438)	1.936*** (0.441)		1.983*** (0.455)	
Observations	7,010	7,010	7,010	6,690	6,690
R-squared	0.088				

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

that if the endogeneity problem is ignored, the public insurance coverage has the negative and insignificant coefficient.

We move to discuss the first step probit marginal effects in Column (3). The number of the health care providers per 1000 persons has negative and highly significant marginal effect of -0.114 on the public insurance coverage. It implies that if the household living a city with the larger number of the health care providers per 1000 persons, the household is less likely to be covered by the public insurance. This result is a bit weird and might be due to the fact that the private health care providers are also included. In addition, the household head's health status does not significantly affect the public insurance coverage and their employment characteristics is more relevant.

Another important issue that need to be taken into account is the validity of the instrumental variable. The significant marginal effect of the number of the health care providers per 1000 persons confirms that it does affect the public insurance coverage. In addition, we need to examine the tested χ^2 value of the instrumental variable. The tested χ^2 value is 12.28 (P-value: 0.0000). Next, we need to consider whether the instrumental variable affects the out-of-pocket expenses or not. It is relevant to consider an OLS estimation, in which the dependent variable is the residuals obtained after the second step regression and the independent variable is the number of the health care providers per 1000 persons. The results are reported in Column (3) of Panel A of Table 3.9. The insignificant coefficient of the health care providers per 1000 persons implies that it is uncorrelated with the residuals in the second step regression, thus it does not affect the out-of-pocket expenses. The previous arguments jointly indicate that the health care providers per 1000 persons is a valid instrumental variable.

If we use the number of the medical technical persons per 1000 persons as the instrumental variable, we find the similar results in both the first and second step

estimations. The public insurance coverage positively and significantly affects the out-of-pocket expenses. The households with the heads being in a non-bad health status spend less. The significant λ implies that the endogeneity problem induced by the public insurance coverage does exist and the two-step estimation procedure specification resolves it. In the first step, the number of the medical technical persons per 1000 persons has negative and significant marginal effect on the probability of the public insurance coverage. The subjective proxy of the health status does not affect the public insurance coverage, whereas the employment characteristics affects it. However, the number of the medical technical persons per 1000 persons is not a valid instrumental variable. This is because although the marginal effect of the number of the medical technical persons per 1000 persons is significant and its coefficient reported in Column (4) of Panel A of Table 3.9 is insignificant, the tested χ^2 value 3.40 (P-value: 0.1253).

Table 3.6 reports the effect of the public insurance coverage on the out-of-pocket expense if the objective proxy of the health status is considered. Column (2) reports the second step estimation results if the instrumental variable is the number of the health care providers per 1000 persons. Comparing the coefficients of the same variable in Column (2) of Table 3.5 and 3.6, we find that magnitude and does not change significantly. The public insurance coverage still has positive and significant effect on the out-of-pocket expenses. The number of symptoms, which is the objective proxy of the health status, positively and significantly affects the out-of-pocket expenses. It implies that the households with their heads having the health risk are more likely to have higher out-of-pocket expenses. The significant coefficient of λ implies that the endogeneity problem does exist. If the endogeneity problem is ignored, the public insurance coverage still has negative and insignificant effect on the out-of-pocket expenses.

If we compare the marginal effect of the same variable in Column (3) of Table 3.5 and 3.6, we can also find that its magnitude does not change significantly. The number of the health care providers per 1000 persons negatively and significantly affects the public insurance coverage. The number of the health care providers per 1000 persons is a valid instrumental variable, since its marginal effect on the public insurance coverage is significant in the first step, the tested χ^2 value after the first step estimation is 15.44 (P-value: 0.0000) and its coefficient reported in Column (1) of Panel A of Table 3.9 is not significant. Finally, the number of the medical technical persons per 1000 persons is not a valid instrumental variable, since the tested χ^2 value after the first step estimation is 3.76 (P-value: 0.1247).

Next, we explore the effect of the public insurance coverage on the saving rate after the 1998 health care reform. Table 3.7 reports the estimation results if the subjective proxy of the health status is considered. We now discuss the results of the second step regression if the instrumental variable is the number of the health care providers per 1000 persons. The public insurance coverage has a positive and significant coefficient of 0.205 after the 1998 health care reform. It implies that the households with the heads covered by the public insurance save 20 percent more with respect to those covered by the private insurance or none after the 1998 health care reform. If the heads are covered by BIS, they prefer to use the health care services by the hospitals; in the meanwhile, the hospitals deliver the high-tech and high costs treatments, tests, drugs and inpatient services to them (Wagstaff and Linderlow 2008). If the heads are the BIS contributors, the households may have the precautionary saving motives in order to use the health care services provided by the hospitals in the future. Ignoring the endogeneity problem induced by the public insurance coverage may result in a selection bias. In the second step regression, the significant coefficient of λ implies that the endogeneity problem induced by the public insurance coverage does exist and the two-step estimation resolves it. If the endogeneity problem is ignored, the public

Table 3.6: Out-of-pocket Expenses in 2002: Objective Proxy of Health Status

VARIABLES	(1) OOP/1000 OLS	(2) OOP/1000 Second Step	(3) PI First Step ME	(4) OOP/1000 Second Step	(5) PI First Step ME
No. of health providers per 1000 persons			-0.114*** (0.0306)		
No. of beds per 1000 persons					-0.00312* (0.00111)
Dummy of public insurance	-0.00340 (0.0341)	0.396* (0.216)		0.469** (0.232)	
No. of symptoms	0.204*** (0.0202)	0.204*** (0.0203)	-0.00108 (0.00847)	0.209*** (0.0211)	-0.000563 (0.00873)
Age	-0.0772*** (0.0188)	-0.0765*** (0.0190)	-0.00590 (0.00791)	-0.0764*** (0.0195)	-0.00360 (0.00809)
Age square	0.00100*** (0.000216)	0.000996*** (0.000218)	6.73e-05 (9.12e-05)	0.00100*** (0.000223)	3.97e-05 (9.31e-05)
Household size	0.309*** (0.0248)	0.320*** (0.0257)	-0.0283*** (0.0101)	0.332*** (0.0265)	-0.0188* (0.0105)
Dummy of any children	-0.167*** (0.0532)	-0.196*** (0.0557)	0.0962*** (0.0248)	-0.223*** (0.0576)	0.0890*** (0.0253)
Per capita income	2.28e-05*** (3.42e-06)	1.72e-05*** (4.57e-06)	1.91e-05*** (1.64e-06)	1.61e-05*** (4.75e-06)	1.91e-05*** (1.67e-06)
Education years	0.0138** (0.00539)	0.00714 (0.00648)	0.0178*** (0.00227)	0.00537 (0.00691)	0.0182*** (0.00237)
Working years	-0.00222 (0.00179)	-0.00614** (0.00276)	0.0106*** (0.000734)	-0.00705** (0.00290)	0.0105*** (0.000756)
Permanent employment	0.0419 (0.0340)	-0.0221 (0.0483)	0.172*** (0.0141)	-0.0347 (0.0514)	0.173*** (0.0145)
Dummy of enterprises	0.0601 (0.0436)	0.0309 (0.0466)	0.0841*** (0.0187)	0.0113 (0.0487)	0.0827*** (0.0193)
Economic sector	YES	YES	YES	YES	YES
Dummy of Beijing	0.308*** (0.0802)	0.253*** (0.0860)	0.161*** (0.0242)	0.241*** (0.0880)	0.171*** (0.0245)
Dummy of Shanxi	-0.133* (0.0729)	-0.0798 (0.0787)	-0.173*** (0.0350)	-0.0698 (0.0807)	-0.171*** (0.0352)
Dummy of Liaoning	0.111 (0.0718)	0.107 (0.0724)	-0.0370 (0.0336)	0.104 (0.0733)	0.00403 (0.0305)
Dummy of Jiangsu	-0.280*** (0.0736)	-0.229*** (0.0791)	-0.190*** (0.0365)	-0.221*** (0.0807)	-0.165*** (0.0355)
Dummy of Anhui	-0.180** (0.0769)	-0.194** (0.0777)	0.0254 (0.0327)	-0.198** (0.0788)	0.0483 (0.0312)
Dummy of Henan	-0.0635 (0.0720)	-0.0436 (0.0733)	-0.0927*** (0.0346)	-0.0417 (0.0744)	-0.0609* (0.0326)
Dummy of Hubei	0.0857 (0.0716)	0.0682 (0.0727)	0.0105 (0.0309)	0.0621 (0.0738)	0.0391 (0.0289)
Dummy of Guangdong	0.202*** (0.0756)	0.203*** (0.0762)	0.0191 (0.0322)	0.197** (0.0773)	0.0112 (0.0363)
Dummy of Chongqing	0.0714 (0.0890)	0.0414 (0.0910)	0.0560 (0.0351)	0.0342 (0.0925)	0.0768** (0.0335)
Dummy of Sichuan	6.31e-05 (0.0741)	-0.0283 (0.0762)	0.0716*** (0.0276)	-0.0378 (0.0774)	0.0788*** (0.0277)
Dummy of Yunnan	-0.0281 (0.0726)	-0.0688 (0.0763)	0.0814*** (0.0280)	-0.113 (0.0882)	0.0963*** (0.0305)
lambda		-0.237* (0.126)		-0.278** (0.136)	
Constant	0.999** (0.434)	0.974** (0.437)		0.974** (0.450)	
Observations	7,010	7,010	7,010	6,690	6,690
R-squared	0.080				

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

insurance coverage has a positive and insignificant coefficient and the magnitude is much smaller.

The results of the first step probit marginal effects in Column (3) are exactly the same as those reported in Column (3) of Table 3.5, since both of them use the same dependent variable and the same set of control variables. In addition, the instrumental variable is valid for the first step estimation. The results of the validity test for the second step are given in Column (3) of Panel B of Table 3.9. The insignificant coefficient of the number of the health care providers per 1000 persons indicates the instrumental variable is valid for the second step. Consequently, the number of the health care providers per 1000 persons is a valid instrumental variable for using the two-step estimation procedure to estimate the effect of the public insurance coverage on the saving rate using the two-step estimation procedure. In addition, the medical technical persons per 1000 persons is not valid instrumental variable, since the tested χ^2 value is 3.34 (P-value: 0.1252) and the coefficient of the instrumental variable reported in Column (4) of Panel B of Table 3.9 is significant.

If the objective proxy of the health status is considered, we find the same results. The public insurance coverage has positive and highly significant effect on the saving rate. In addition, the highly significant λ implies that ignoring the endogeneity problem induces a selection bias. In the OLS estimation specification, the public insurance coverage has positive and insignificant effect on the saving rate. The number of the health care providers per 1000 persons is a valid instrumental variable, since its coefficient in the first step estimation is significant, the tested χ^2 value is 20.11 (P-value: 0.0000) and its coefficient reported in Column (1) of Panel B of Table 3.9 is not significant; whereas the number of the medical technical persons per 1000 persons is not a valid instrumental variable.

Using two-step estimation procedure, we find that in 2002 the public insurance coverage positively and significantly affect the household out-of-pocket expenses and

Table 3.7: Saving Rate in 2002: Subjective Proxy of Health Status

VARIABLES	(1) sr OLS	(2) sr Second Step	(3) PI First Step ME	(4) sr Second Step	(5) PI First Step ME
No. of health providers per 1000 persons			-0.114*** (0.0307)		
No. of beds per 1000 persons					-0.00314* (0.00112)
Dummy of public insurance	0.00652 (0.00798)	0.205*** (0.0503)		0.207*** (0.0534)	
Health status: very good	0.0194 (0.0183)	0.0248 (0.0191)	-0.0171 (0.0334)	0.0208 (0.0198)	-0.0420 (0.0356)
Health status: good	0.0214 (0.0176)	0.0137 (0.0184)	0.0574* (0.0312)	0.00623 (0.0190)	0.0473 (0.0328)
Health status: just so so	-0.00822 (0.0179)	-0.0123 (0.0186)	0.0351 (0.0314)	-0.0189 (0.0193)	0.0156 (0.0334)
Age	-0.00504 (0.00442)	-0.00463 (0.00461)	-0.00764 (0.00792)	-0.00567 (0.00466)	-0.00555 (0.00810)
Age square	5.99e-05 (5.07e-05)	5.78e-05 (5.28e-05)	8.20e-05 (9.12e-05)	6.79e-05 (5.34e-05)	5.60e-05 (9.31e-05)
Household size	0.0280*** (0.00582)	0.0335*** (0.00621)	-0.0299*** (0.0101)	0.0317*** (0.00632)	-0.0198* (0.0106)
Dummy of any children	-0.0425*** (0.0124)	-0.0565*** (0.0134)	0.0992*** (0.0249)	-0.0601*** (0.0137)	0.0914*** (0.0254)
Per capita income	1.61e-05*** (7.99e-07)	1.33e-05*** (1.09e-06)	1.90e-05*** (1.65e-06)	1.35e-05*** (1.12e-06)	1.90e-05*** (1.67e-06)
Education years	-0.00466*** (0.00126)	-0.00783*** (0.00153)	0.0176*** (0.00228)	-0.00761*** (0.00161)	0.0181*** (0.00238)
Working years	0.000567 (0.000417)	-0.00134** (0.000644)	0.0107*** (0.000736)	-0.00123* (0.000667)	0.0106*** (0.000758)
Permanent employment	0.0283*** (0.00794)	-0.00327 (0.0114)	0.174*** (0.0141)	-0.00595 (0.0120)	0.175*** (0.0145)
Economic sector	YES	YES	YES	YES	YES
Dummy of enterprises	0.00441 (0.0102)	-0.00940 (0.0112)	0.0824*** (0.0187)	-0.00399 (0.0115)	0.0794*** (0.0193)
Dummy of Beijing	-0.104*** (0.0189)	-0.128*** (0.0206)	0.152*** (0.0254)	-0.130*** (0.0207)	0.161*** (0.0258)
Dummy of Shanxi	0.0853*** (0.0171)	0.113*** (0.0191)	-0.180*** (0.0353)	0.113*** (0.0193)	-0.180*** (0.0356)
Dummy of Liaoning	0.0221 (0.0167)	0.0208 (0.0174)	-0.0412 (0.0339)	0.0194 (0.0174)	-0.000661 (0.0308)
Dummy of Jiangsu	0.0325* (0.0172)	0.0584*** (0.0191)	-0.197*** (0.0368)	0.0572*** (0.0192)	-0.173*** (0.0359)
Dummy of Anhui	0.0553*** (0.0179)	0.0497*** (0.0187)	0.0150 (0.0335)	0.0482** (0.0187)	0.0364 (0.0320)
Dummy of Henan	0.0996*** (0.0168)	0.110*** (0.0177)	-0.0978*** (0.0348)	0.109*** (0.0177)	-0.0664** (0.0328)
Dummy of Hubei	0.0151 (0.0167)	0.00929 (0.0175)	-0.00257 (0.0317)	0.00887 (0.0175)	0.0249 (0.0297)
Dummy of Guangdong	-0.0429** (0.0177)	-0.0398** (0.0185)	0.00493 (0.0333)	-0.0419** (0.0185)	-0.00498 (0.0375)
Dummy of Chongqing	-0.0633*** (0.0208)	-0.0751*** (0.0218)	0.0427 (0.0363)	-0.0769*** (0.0218)	0.0616* (0.0349)
Dummy of Sichuan	-0.0204 (0.0175)	-0.0338* (0.0185)	0.0606** (0.0285)	-0.0353* (0.0185)	0.0666** (0.0286)
Dummy of Yunnan	0.0609*** (0.0170)	0.0434** (0.0183)	0.0701** (0.0289)	0.0546*** (0.0208)	0.0830*** (0.0318)
lambda		-0.118*** (0.0295)		-0.117*** (0.0313)	
Constant	0.144 0.103	0.127 0.107		0.163 0.109	
Observations	6,951	6,951	6,951	6,632	6,632
R-squared	0.107				

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Table 3.8: Saving Rate in 2002: Objective Proxy of Health Status

VARIABLES	(1) sr OLS	(2) sr Second Step	(3) PI First Step ME	(4) sr Second Step	(5) PI First Step ME
No. of health providers per 1000 persons			-0.114*** (0.0306)		
No. of beds per 1000 persons					-0.00312 (0.00211)
Dummy of public insurance	0.00656 (0.00796)	0.218*** (0.0511)		0.227*** (0.0546)	
No. of symptoms	-0.0139*** (0.00470)	-0.0139*** (0.00492)	-0.00108 (0.00847)	-0.0137*** (0.00506)	-0.000563 (0.00873)
Age	-0.00549 (0.00442)	-0.00538 (0.00463)	-0.00590 (0.00791)	-0.00659 (0.00470)	-0.00360 (0.00809)
Age square	6.50e-05 (5.07e-05)	6.57e-05 (5.31e-05)	6.73e-05 (9.12e-05)	7.74e-05 (5.39e-05)	3.97e-05 (9.31e-05)
Household size	0.0277*** (0.00582)	0.0335*** (0.00624)	-0.0283*** (0.0101)	0.0316*** (0.00639)	-0.0188* (0.0105)
Dummy of any children	-0.0428*** (0.0124)	-0.0576*** (0.0135)	0.0962*** (0.0248)	-0.0614*** (0.0138)	0.0890*** (0.0253)
Per capita income	1.62e-05*** (7.99e-07)	1.32e-05*** (1.10e-06)	1.91e-05*** (1.64e-06)	1.33e-05*** (1.14e-06)	1.91e-05*** (1.67e-06)
Education years	-0.00453*** (0.00126)	-0.00797*** (0.00156)	0.0178*** (0.00227)	-0.00788*** (0.00164)	0.0182*** (0.00237)
Working years	0.000536 (0.000417)	-0.00149** (0.000652)	0.0106*** (0.000734)	-0.00146** (0.000678)	0.0105*** (0.000756)
Permanent employment	0.0287*** (0.00794)	-0.00461 (0.0115)	0.172*** (0.0141)	-0.00825 (0.0121)	0.173*** (0.0145)
Dummy of enterprises	0.00387 (0.0102)	-0.0112 (0.0113)	0.0841*** (0.0187)	-0.00636 (0.0117)	0.0827*** (0.0193)
Economic sector	YES	YES	YES	YES	YES
Dummy of Beijing	-0.111*** (0.0187)	-0.139*** (0.0207)	0.161*** (0.0242)	-0.142*** (0.0210)	0.171*** (0.0245)
Dummy of Shanxi	0.0843*** (0.0171)	0.113*** (0.0191)	-0.173*** (0.0350)	0.114*** (0.0194)	-0.171*** (0.0352)
Dummy of Liaoning	0.0199 (0.0167)	0.0180 (0.0175)	-0.0370 (0.0336)	0.0166 (0.0176)	0.00403 (0.0305)
Dummy of Jiangsu	0.0285* (0.0172)	0.0548*** (0.0191)	-0.190*** (0.0365)	0.0544*** (0.0193)	-0.165*** (0.0355)
Dummy of Anhui	0.0552*** (0.0179)	0.0474** (0.0188)	0.0254 (0.0327)	0.0453*** (0.0189)	0.0483 (0.0312)
Dummy of Henan	0.0991*** (0.0168)	0.109*** (0.0177)	-0.0927*** (0.0346)	0.108*** (0.0178)	-0.0609* (0.0326)
Dummy of Hubei	0.0128 (0.0167)	0.00433 (0.0176)	0.0105 (0.0309)	0.00310 (0.0176)	0.0391 (0.0289)
Dummy of Guangdong	-0.0483*** (0.0176)	-0.0478*** (0.0184)	0.0191 (0.0322)	-0.0503*** (0.0185)	0.0112 (0.0363)
Dummy of Chongqing	-0.0627*** (0.0207)	-0.0777*** (0.0220)	0.0560 (0.0351)	-0.0805*** (0.0221)	0.0768** (0.0335)
Dummy of Sichuan	-0.0234 (0.0174)	-0.0400** (0.0186)	0.0716*** (0.0276)	-0.0426** (0.0187)	0.0788*** (0.0277)
Dummy of Yunnan	0.0577*** (0.0169)	0.0368** (0.0184)	0.0814*** (0.0280)	0.0476** (0.0211)	0.0963*** (0.0305)
lambda		-0.125*** (0.0299)		-0.129*** (0.0320)	
Constant	0.173* (0.102)	0.163 (0.106)		0.198* (0.108)	
Observations	6,951	6,951	6,951	6,632	6,632
R-squared	0.106				

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Table 3.9: Validity Test of Instrumental Variables

Panel A: Dependent Variables: Residuals after Different Two-step Estimation Specifications of Out-of-pocket Expenses

Variable/Specifications	(1)	(2)	(3)	(4)
	Table 3.6 (2)-(3)	Table 3.6 (4)-(5)	Table 3.5 (2)-(3)	Table 3.5 (4)-(5)
No. of health providers per 1000 persons	-0.0382 (0.0550)		-0.0321 (0.0548)	
No. of beds per 1000 persons		-0.00360 (0.00370)		-0.00371 (0.00369)
Constant	0.0108 (0.0209)	0.0179 (0.0234)	0.00910 (0.0209)	0.0183 (0.0233)
Observations	7,014	6,702	7,014	6,702
R-squared	0.0001	0.0001	0.0000	0.0002

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Panel B: Dependent Variables: Residuals after Different Two-step Estimation Specifications of Saving Rate

Variable/Specifications	(1)	(2)	(3)	(4)
	Table 3.8 (2)-(3)	Table 3.8 (4)-(5)	Table 3.7 (2)-(3)	Table 3.7 (4)-(5)
No. of health providers per 1000 persons	-0.00457 (0.0128)		-0.00517 (0.0128)	
No. of beds per 1000 persons		-0.00187** (0.000855)		-0.00190** (0.000815)
Constant	0.00130 (0.00491)	0.00927* (0.00543)	0.00147 (0.00490)	-0.00943* (0.00541)
Observations	6956	6645	6956	6645
R-squared	0.0000	0.0007	0.0000	0.0000

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

the saving rate. It seems that the public insurance after the 1998 reform may not be an effective source to protect against income losses and makes the households have a stronger saving motive.

3.3.4 Policy Implication

Our estimation results suggest that before the 1998 health care reform, the public insurance coverage (LIS or GIS) served as a cushion against the health risk, reducing the out-of-pocket expenses and the need to save for precautionary motives. However, after the 1998 health care reform the public insurance coverage has positive effect on the household out-of-pocket expenses and motivates the household to save more. This might be due to the fact that the BIS contributors prefer to use the services provided by the higher level of the health care providers, such as the hospitals, while the hospitals deliver high-tech and high cost medical treatments, examinations, drugs, etc. to them. The Chinese government should pay attention on the health care cost escalation, especially controlling the rising costs delivered by the hospitals. The government has to determine the upper bound of the profit rate of the hospitals. Second, the gov-

ernment should also encourage the development of the Community Sanitary Service Center, which provides the low costs and the basic outpatient services to residents.⁹ The BIS beneficiaries could use the Community Sanitary Service Center if they do not have catastrophic health problems. Third, BIS reimburses its contributors' inpatient medical cost if it is less than four times of the average annual income of that city via the Social Risk Pooling (SRP). Each local government could develop other supplementary public insurance schemes, which only cover the contributors' inpatient costs. Finally, China should also enhance the commercial insurance schemes, which are effective sources to protect the health risk. We believe that all these suggested policy implications may serve as the sources to protect the household's health risk and income loss, and also may reduce the household out-of-pocket expenses and the precautionary saving motives.

3.4 Conclusion and Discussion

The Chinese health care reform is an important component of the social security reforms. In this paper we focus on the third stage of the health care system reform occurred in 1998, in which the Chinese government established a new public insurance scheme, called the Basic Insurance Scheme (BIS) nationwide. BIS is financed by the premium contributions from both the employer and the employee. Different from the previous public insurance schemes, namely both the Labor Insurance Scheme and the Government Insurance Scheme, BIS does not reimburse its contributors' health care costs entirely, instead it reimburses all the contributors' outpatient expense only if it is less than the medical saving accounts and their inpatient expense will be paid out-of-pocket if it exceeds some fixed ceiling determined by each local government.

⁹The community is the smallest composition of the Chinese society. The Community Sanitary Service Center is jointly organized by the local distinct government and the health care department. It provides the basic outpatient service for the local community residents.

Since the public insurance coverage is endogenous, the best estimation strategy is to use the two-step estimation procedure and use the valid instrumental variable. However, we explore the public insurance coverage effects on the out-of-pocket expenses and the saving rate in 1995 using the simple OLS estimation procedure, because of the lack of the instrumental variable; while its effects on the out-of-pocket expenses and saving rate in 2002 using the two-step estimation procedure. For what concerns the determinants of the out-of-pocket expenses, we find that in 1995 the public insurance negatively and significantly affects the out-of-pocket expenses, since LIS and GIS totally reimburse the health care costs of the households' heads and partially of those of their dependents. These results suggest that before the 1998 health care reform, the households with the heads covered by the public insurance spend 26.9 Yuan (equivalently 9.51 US dollar in 2011) less than those uncovered by the public scheme. In 1995 the public insurance served as a cushion against the health risk, reducing the out-of-pocket expenses and the need to save for precautionary motive. Indeed, before the 1998 health care reform, the public insurance coverage had a negative and significant effect on the saving rate. The results suggest that the households with the heads covered by the public insurance saved 1.81 percent less than those uncovered by the public scheme.

For the 2002 wave, we use the two-step estimation procedure to explore the public insurance coverage effect on the household out-of-pocket expenses and the saving rate, where the endogeneity problem induced by the public insurance coverage is taken into account and use the number of the health care providers per 1000 persons at the city level as the instrumental variable. We find that after the 1998 health care reform, the public insurance positively and significantly affect the out-of-pocket expenses, maybe because the BIS contributors prefer to use the high-tech and high-cost services provided by hospitals. Our results of the out-of-pocket expenses are consistent with the findings of existing studies (Wagstaff and Linderlow 2008). This

finding suggests that the public health insurance seems to be ineffective as a source of protection against income losses and makes the households to have a stronger saving motive. The results suggest that the households with the heads covered by the public insurance on average save around 20 percent more than those uncovered by the public scheme. In addition, the results of validity test suggest that the number of the health care providers per 1000 persons at the city level is the valid instrumental variable.

To conclude, although the Chinese health care reform in 1998 established a risk pooling mechanism at the city level all over the country and alleviated the employers burden, it cannot be neglected that this reform also made the urban households be less protected and induced them to save more in order to deal with potential future health care expenditure due to health shocks.

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Estratto per riassunto della tesi di dottorato

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Dottorato: Economia e Organizzazione

Ciclo: XXIII

Titolo della tesi: Three Essays in Chinese Reforms and Household Savings

Abstract: In this dissertation, we study three issues in Chinese reforms and household saving decisions. In Chapter 1, we review the existing studies on the relation between various of the Chinese reforms and the household saving decisions. Chapter 2 focus on the housing finance reform effect on the saving rate. Using the two-step estimation procedure, we find that as a pillar of the housing finance reform, the Housing Accumulation Fund positively affect the household saving rate and the home ownership. In Chapter 3, we discuss the effect of the health care reform occurred in 1998. We find that the 1998 reform makes the urban households be less protected and induced them to save more in order to deal with potential future health care expenditure due to health shocks.

Estratto: In questa tesi, noi analizziamo tre aspetti riguardanti le scelte di risparmio delle famiglie, in Cina. Nel primo capitolo, sono stati vagliati gli studi esistenti sulla relazione tra le scelte di risparmio delle famiglie e la varie riforme di politica economica cinese. Il secondo capitolo si concentra sugli effetti della riforma del credito immobiliare sui tassi di risparmio. Attraverso l'utilizzo di una procedura di stima in due tempi, constatiamo che l'introduzione del Fondo di Accumulo per la Casa (Housing Accumulation Fund), pilastro della riforma del credito immobiliare, influenza positivamente il tasso di risparmio delle famiglie e di proprietà immobiliare. Nel terzo capitolo, discutiamo gli effetti della riforma della sanità del 1998. I nostri risultati mostrano che la riforma ha reso le famiglie che vivono nelle zone urbane meno tutelate. Questo le incentiva ad aumentare i propri risparmi, in modo da assicurarsi contro eventuali spese mediche, dovute a peggioramenti significativi delle proprie condizioni di salute.